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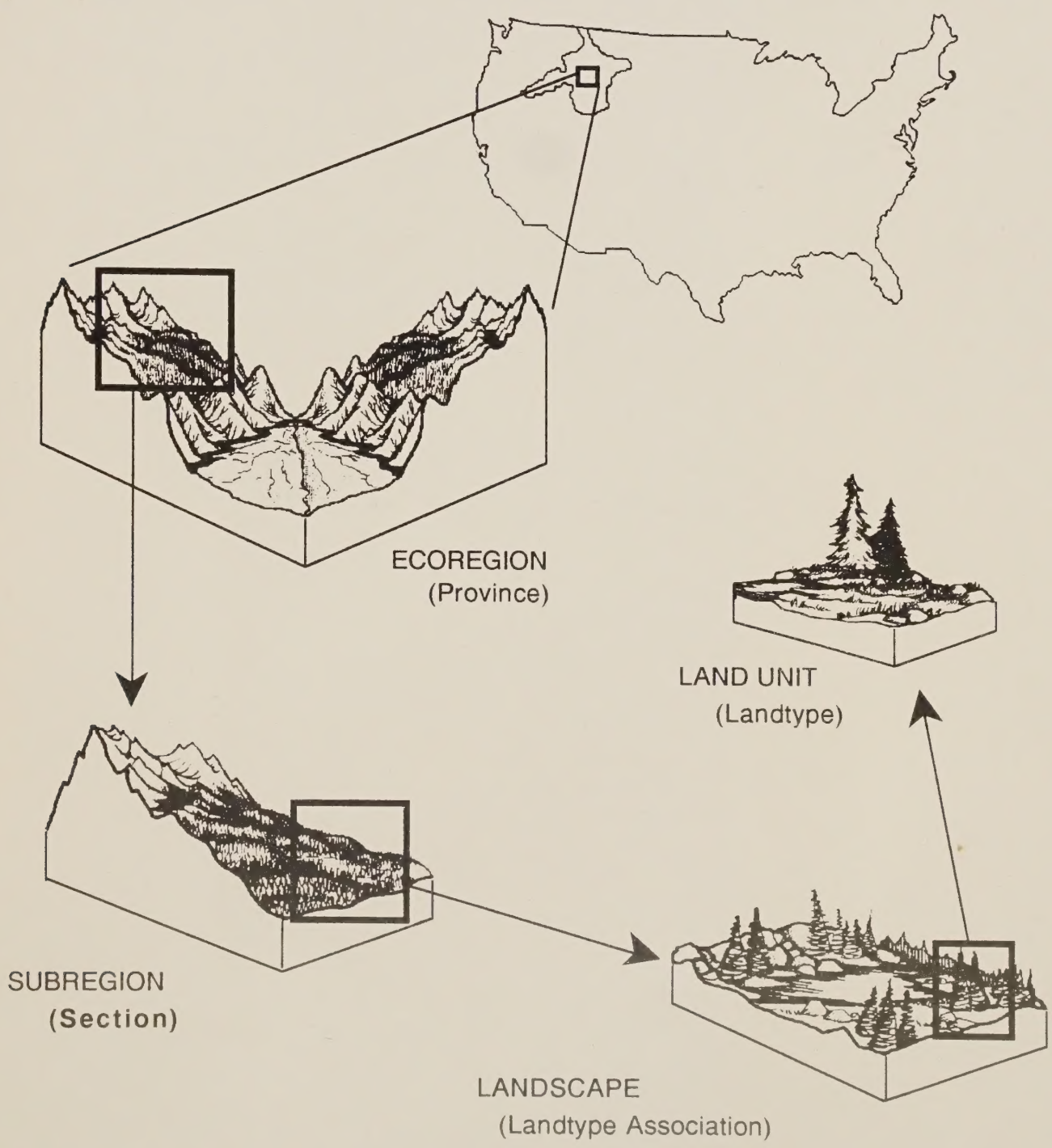
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Ecological Subregions of the United States: Section Descriptions

Washington, DC

July 1994



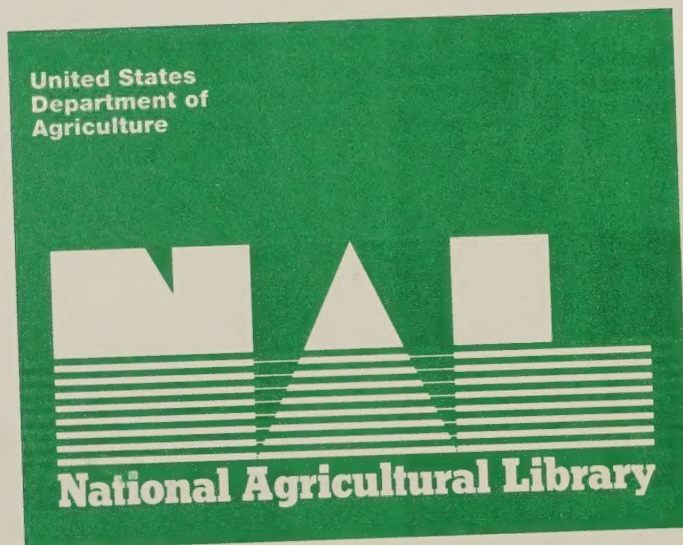
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The Cover:

Ecosystems are nested from local to global scales; their spatial distribution and geographical extent can be shown on maps. The Forest Service National Hierarchical Framework of Ecological Units is based on this relationship and can be applied at a range of planning and analysis scales, from ecoregion to land unit. A typical ecological unit for each scale is shown in parentheses. (The cover was designed by Mark Windham and Richard Cline, USDA Forest Service).



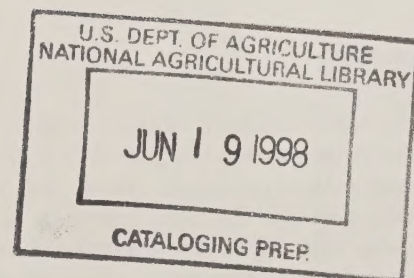
Ecological Subregions of the United States: Section Descriptions

WO-WSA-5

Compiled by W. Henry McNab and Peter E. Avers

Prepared in cooperation with
Regional Compilers and the
ECOMAP Team of the Forest Service

July 1994



Preface

This document contains the biophysical descriptions of the Sections as depicted on the map "Ecoregions and Subregions of the United States," dated June 1994. The basis for the map and this document is the National Hierarchical Framework of Ecological Units (ECOMAP 1993). This framework provides a standardized method for classifying, mapping, and describing ecological units at various geographic planning and analysis scales.

This text, which supplements the map by describing the delineated Section ecological units, is the product of collaboration and teamwork by compilers from all Forest Service Regions, other Forest Service administrative units, States, and individuals. Because this document presents information on a wide range of environmental, biological, and cultural characteristics of ecosystems at the subregion scale, many compilers were involved in its development. Each compiler drew upon personal knowledge of environmental relationships and mapping principles and obtained help from other resource specialists to develop these map unit descriptions.

This text should be viewed as a continually evolving and refined draft of our ability to recognize and describe ecosystems at the subregion scale. Because this is the first edition and it was prepared by many persons in a short time, this text undoubtedly contains errors and perhaps omits pertinent information. Also, because our current knowledge of ecosystems is limited, new relationships will be discovered continually. The Forest Service is committed to management based on ecological principles and intends to update the subregion map and this text as required. Users should report errors in this document and new knowledge applicable at the Section level in the national hierarchy to the Forest Service Region primarily responsible for its compilation. Addresses of Regional contacts are listed in Appendix E. Comments and suggestions about this document as a whole should be directed to the Chief, USDA Forest Service, Box 96090, Washington, DC. 20090-6090, ATTN: Ecosystem Management.

Acknowledgments

The development and completion of this national document in a relatively short time period is a direct result of the coordination, persistent efforts, and diligent teamwork of many persons. Principal compilers were responsible for map unit delineations, developed the overall framework of the Section map unit descriptions, compiled map unit descriptions, and guided overall coordination and completion of tasks associated with this text in their Regions. Assistant compilers aided

some principal compilers by locating and organizing resource information pertaining to broad geographical areas, synthesizing general information into succinct summaries, and reviewing map unit descriptions for accuracy. Other assistant compilers made contributions such as developing specific elements of the map unit descriptions or providing technical knowledge and support. Associate compilers participated by serving as subject-matter experts, summarizing information for specific geographical areas, reviewing descriptions for accuracy, and performing other tasks that contributed to the production of this text. Other individuals undoubtedly contributed to this document, but, unfortunately, will remain unknown. This text was produced through the collective, diligent efforts of the following individuals.

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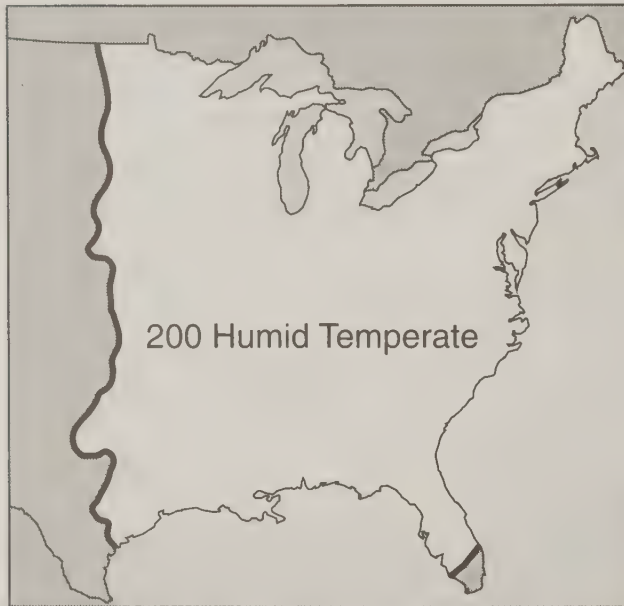
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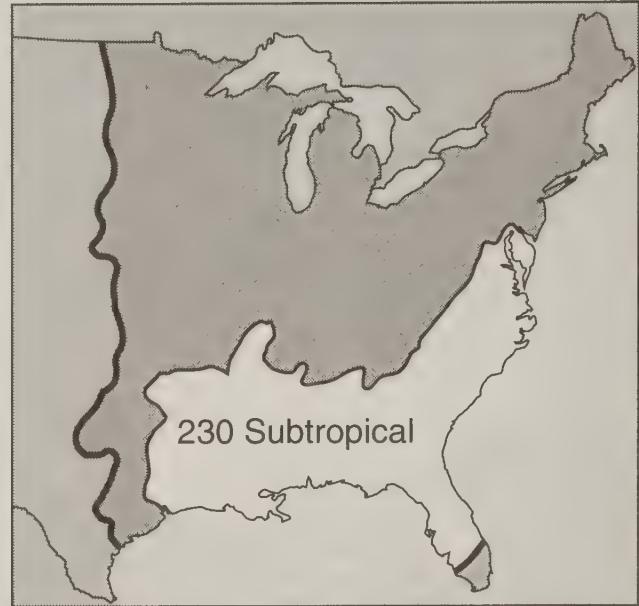
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Hierarchy of Ecoregions at a Range of Scales



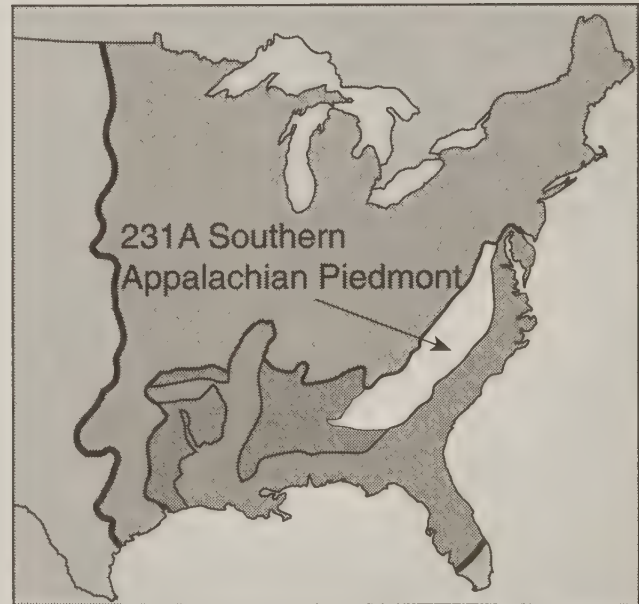
a. Domain



b. Division



c. Province



d. Section

Figure 1.—The upper four levels of ecological units in the Forest Service National Hierarchical Framework consist of Domain, Division, Province, and Section. Selected ecological units of the Humid Temperate Domain, in the eastern United States, are progressively revealed to the Section level to illustrate the hierarchical structure, the identification system, and relative sizes of map units at the ecoregion and subregion planning and analysis scales. (Hierarchy of ecoregions at a range of scales, R.G. Bailey, 1994).

Introduction

Background

The USDA Forest Service adopted a policy of ecosystem management on June 4, 1992, that applied to national forests, grasslands and research programs. By July, an Ecological Classification and Mapping Task Team (ECOMAP) was formed in the Washington Office to develop a consistent approach to ecosystem classification and mapping at multiple geographic scales. This was identified by the Chief as a critical first step in providing field units with an essential tool and scientific basis to plan for and implement ecosystem management. Soon afterwards a subgroup of ECOMAP was formed with representatives from all Forest Service Regions, two Research Stations, the USDA Soil Conservation Service, and The Nature Conservancy. They met in September in Lincoln, NE, to begin development of a land classification system. The structure of the National Hierarchical Framework of Ecological Units (Table 1) was formulated at this meeting and was adopted by the Forest Service on November 5, 1993 (ECOMAP 1993).

Briefly, as described by ECOMAP (1993), the Framework "...is a regionalization, classification, and mapping system for stratifying the Earth into progressively smaller areas of increasingly uniform ecological potentials. Ecological types are classified and ecological units are mapped based on associations of those biotic and environmental factors that directly affect or indirectly express energy, moisture, and nutrient gradients which regulate the structure and function of ecosystems. These factors include climate, physiography, water, soils, air, hydrology, and potential natural communities."

In November 1992, the subgroup began the process of producing a national map of ecological units at the

Section level of the subregion planning and analysis scale. During the process of delineating Sections, ecoregion boundaries were revised. The map "Ecoregions and Subregions of the United States" was compiled by December 1993 and printed in June 1994 (Bailey and others 1994). The Section map unit descriptions in this text were produced after the map was compiled. A new, revised ecoregion map was also printed in June 1994. Bailey's publication (Bailey, 1980), which describes the Domains, Divisions, and Provinces of the United States is being revised (Bailey, In prep.).

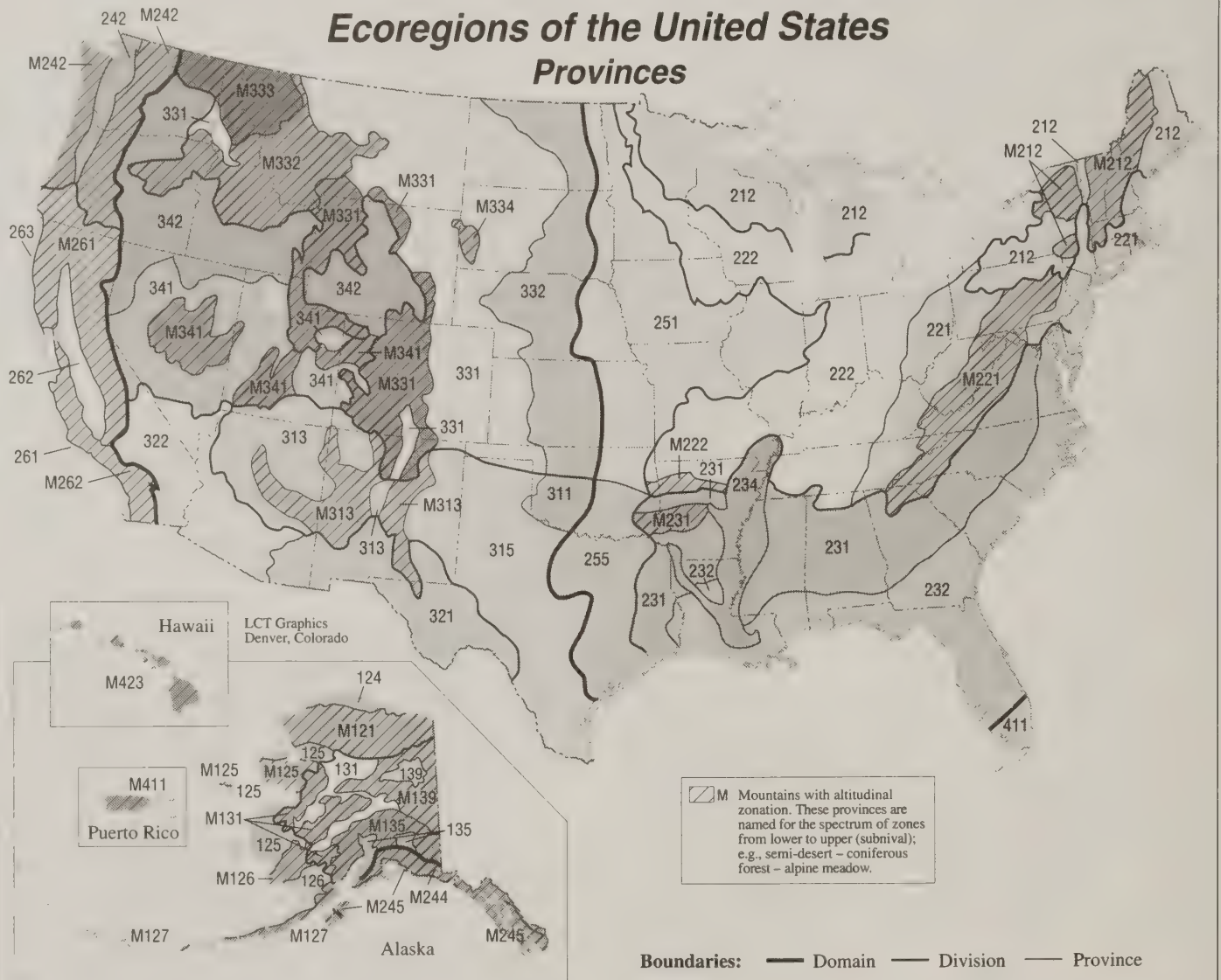
Work is underway by the Forest Service and other agencies to subdivide Sections into Subsections, the next lower level in the hierarchy. In addition, maps are being developed at landscape and land unit scales on national forests and other selected areas in the United States to provide detailed information for project implementation. Thus, delineation and description of ecosystems at all levels in the hierarchy are components of an ongoing process that will result in a series of maps and explanatory texts to meet planning and analysis objectives (Figure 1). Each map and each descriptive text documents our current knowledge and provides a basis for study and communication among natural resource managers and planners.

In summary, the National Hierarchical Framework provides a scientific basis for regionalization of ecosystems into successively smaller, more homogeneous units. At the Section level, these units allow managers, planners, and scientists in the Forest Service, and in cooperation with other agencies, to study management problems on a multi-forest and statewide basis; organize data collected during broad-scale resource inventories; and interpret these data among regions.

Table 1.—The Forest Service National Hierarchical Framework of Ecological Units.

Planning and analysis scale	Ecological units	Purpose, objectives, and general use	General size range
Ecoregion			
Global	Domain	Broad applicability for modeling and sampling, strategic planning and assessment, and international planning	Millions to tens of thousands of square miles
Continental	Division		
Regional	Province		
Subregion	Section	Strategic, multi-forest, statewide, and multi-agency analysis and assessment	Thousands to tens of square miles
	Subsection		
Landscape	Landtype association	Forest, area-wide planning and watershed analysis	Thousands to hundreds of acres
Land unit.	Landtype	Project and management area planning and analysis.	Hundreds to less than ten acres.
	Landtype phase.		

Ecoregions of the United StatesProvinces



100 Polar Domain

- 120 Tundra Division
 - 124 Arctic Tundra Province
 - 125 Bering Tundra (Northern) Province
 - 126 Bering Tundra (Southern) Province

M120 Tundra Regime Mountains

- M121 Brooks Range Tundra – Polar Desert Province
- M125 Seward Peninsula Tundra – Meadow Province
- M126 Ahklun Mountains Tundra – Meadow Province
- M127 Aleutian Oceanic Meadow – Heath Province

130 Subarctic Division

- 131 Yukon Intermontane Plateaus Tayga Province
- 135 Coastal Trough Humid Tayga Province
- 139 Upper Yukon Tayga Province

M130 Subarctic Regime Mountains

- M131 Yukon Intermontane Plateaus Tayga – Meadow Province
- M135 Alaska Range Humid Tayga – Tundra – Meadow Province
- M139 Upper Yukon Tayga – Meadow Province

200 Humid Temperate Domain

- 210 Warm Continental Division
- 212 Laurentian Mixed Forest Province

M210 Warm Continental Regime Mountains

- M212 Adirondack – New England Mixed Forest – Coniferous Forest – Alpine Meadow Province

220 Hot Continental Division

- 221 Eastern Broadleaf Forest (Oceanic) Province
- 222 Eastern Broadleaf Forest (Continental) Province

M220 Hot Continental Regime Mountains

- M221 Central Appalachian Broadleaf Forest – Coniferous Forest – Meadow Province
- M222 Ozark Broadleaf Forest – Meadow Province

230 Subtropical Division

- 231 Southeastern Mixed Forest Province
- 232 Outer Coastal Plain Mixed Forest Province
- 234 Lower Mississippi Riverine Forest Province

M230 Subtropical Regime Mountains

- M231 Ouachita Mixed Forest – Meadow Province

240 Marine Division

- 242 Pacific Lowland Mixed Forest Province

M240 Marine Regime Mountains

- M242 Cascade Mixed Forest – Coniferous Forest – Alpine Meadow Province
- M244 Pacific Coastal Mountains Forest – Meadow Province
- M245 Pacific Gulf Coastal Forest – Meadow Province

250 Prairie Division

- 251 Prairie Parkland (Temperate) Province
- 255 Prairie Parkland (Subtropical) Province

260 Mediterranean Division

- 261 California Coastal Chaparral Forest and Shrub Province
- 262 California Dry Steppe Province
- 263 California Coastal Steppe, Mixed Forest, and Redwood Forest Province

M260 Mediterranean Regime Mountains

- M261 Sierran Steppe – Mixed Forest – Coniferous Forest – Alpine Meadow Province
- M262 California Coastal Range Open Woodland – Shrub – Coniferous Forest – Meadow Province

300 Dry Domain

310 Tropical/Subtropical Steppe Division

- 311 Great Plains Steppe and Shrub Province
- 313 Colorado Plateau Semi-Desert Province
- 315 Southwest Plateau and Plains Dry Steppe and Shrub Province

M310 Tropical/Subtropical Steppe Regime Mountains

- M313 Arizona-New Mexico Mountains Semi-Desert – Open Woodland – Coniferous Forest – Alpine Meadow Province

320 Tropical/Subtropical Desert Division

- 321 Chihuahuan Semi-Desert Province
- 322 American Semi-Desert and Desert Province

330 Temperate Steppe Division

- 331 Great Plains-Palouse Dry Steppe Province
- 332 Great Plains Steppe Province

M330 Temperate Steppe Regime Mountains

- M331 Southern Rocky Mountains Steppe – Open Woodland – Coniferous Forest – Alpine Meadow Province
- M332 Middle Rocky Mountains Steppe – Coniferous Forest – Alpine Meadow Province
- M333 Northern Rocky Mountains Forest-Steppe – Coniferous Forest – Alpine Meadow Province
- M334 Black Hills Coniferous Forest Province

340 Temperate Desert Division

- 341 Intermountain Semi-Desert and Desert Province
- 342 Intermountain Semi-Desert Province

M340 Temperate Desert Regime Mountains

- M341 Nevada-Utah Mountains Semi-Desert – Coniferous Forest – Alpine Meadow Province

400 Humid Tropical Domain

410 Savanna Division

- 411 Everglades Province

M410 Savanna Regime Mountains

- M411 Puerto Rico Province

M420 Rainforest Regime Mountains

- M423 Hawaiian Islands Province

Source: R.G. Bailey [Ecoregions of the United States, USDA Forest Service (scale 1:7,500,000, revised 1994)]

Map Unit Descriptions

This text is organized following the national hierarchy structure. Provinces, the lowest hierarchical level at the ecoregion scale (Figure 2), are the basis for chapters. Each chapter consists of the Sections that the Province comprises. Each Section is described by the predominant environmental and biological features used in its delineation, along with other pertinent or characteristic factors. The abbreviated format of this national text necessitated that only a limited amount of information be presented. This information provides the user with a brief description of environmental features that characterize Sections for broad planning and assessment and are useful for comparing landscape characteristics among Sections. Section map unit descriptions were prepared by compilers in each Region following a standard format consisting of 11 elements.

Geomorphology. Geomorphology is the classification, description, nature, origin, and development of present landforms. This element describes the predominant geomorphic processes active in the Section that resulted in formation of the characteristic landforms. The geomorphic province and general landform features may also be described. The range of elevation in ft above mean sea level (m in parentheses) is described. Local relief prevalent in a radius of several miles may be presented.

Lithology and Stratigraphy. Lithology is the description of rocks on the basis of such physical characteristics as manner of origin, composition, and texture. Stratigraphy is the arrangement of rocks as classified by geographic position and chronological order. Classifications by the U.S. Geological Survey were used to provide a consistent national basis for this element (King 1976, King and Beikman 1976, 1978) provide more information on lithology and stratigraphy of the conterminous States; Wahrhaftig (1965) is a source of information for Alaska.

Soil Taxa. Soils were characterized by phases of orders, suborders, or great groups that typify the map unit. Soil moisture and temperature regimes are included to help characterize some map units. The soil taxonomy developed by the USDA Soil Conservation Service (Soil Survey Staff 1992) was the basis of information in this element.

Potential Natural Vegetation. This element presents the potential natural vegetative communities, defined by Küchler (1964), that typify the map unit. Other more specific information on natural vegetation may also be presented, such as potential natural communities,

historic vegetation, or existing communities. Sources of information vary by Region.

Fauna. Characteristic mammals, birds, reptiles, and amphibians of the map unit are named. Some historic, common, and characteristic species are usually listed. Threatened species are provided for some Sections.

Climate. Prevailing climate is characterized in terms of mean annual precipitation in inches (mm in parentheses) and mean annual temperature in degrees Fahrenheit (°C in parentheses). Seasonality of precipitation and relative amount that occurs as snow may also be presented. The growing season is presented as a measure of the length of time during which plant growth may occur, if soil moisture is adequate, and is defined as the mean annual range of days between the last spring and first fall minimum temperatures of 32 °F (0 °C). Additional information is presented by the USDA Soil Conservation Service (1981).

Surface Water Characteristics. Relative occurrence and distinguishing characteristics of rivers, streams, lakes, and wetlands are presented. Some major rivers may be identified.

Disturbance Regimes. This element lists the natural factors and forces that significantly influence ecosystem dynamics within a planning period.

Land Use. This element identifies the predominant changes to natural vegetative communities caused by human uses of land and water resources.

Cultural Ecology. Examples demonstrate how the historical relationship between humans and the natural environment has resulted in modified landscapes.

Compiled by the Forest Service administrative unit primarily responsible for summarizing information pertaining to the Section.

In some instances time was not available to obtain information for one or more elements in the Section description. These elements will be developed more fully when this text of map unit descriptions is revised. The description of some Sections is supplemented with a photograph that illustrates typical landforms, predominant vegetation, and, occasionally, fauna. Information in these Section map unit descriptions is presented in consistent national format. Map unit descriptions were edited for style, but not for technical accuracy. Compilers are responsible for information presented in each Section map unit description.

Figure 2. (Opposite page)—Ecological units delineated at the Province level (Ecoregions of the United States, R.G. Bailey, 1994) are the basis for organization of this document. Each chapter consists of a Province and its components—Sections.

Five appendices present information to supplement the Section map unit descriptions. Appendix A includes references specifically cited in the Introduction and Glossary and lists selected references that provide general information about elements of map unit descriptions for some Provinces and Sections. Appendix B provides the area of each Section and Province. Appendix C is a selected glossary of terms used in map unit descriptions, and Appendix D lists the common and scientific names of selected flora and fauna. Appendix E lists addresses of Regional contacts to whom comments and suggestions regarding specific map unit descriptions should be addressed.

Many potential uses exist for the descriptions of ecosystems presented in this text. Perhaps the most important use is to provide a means for comparison and contrast of environmental conditions among Sections as a basis for region-wide assessment and monitoring programs. Mate-

rial in this text will provide a common basis for communication and coordination among public agencies and groups at the international, national, state, and local levels of planning and evaluation. Researchers, land managers, and other users of research findings will have a common basis for suggesting limits of applicability of results from experimental studies. Another potential use of information in this document will be to provide a uniform basis for planning areas of coordinated work, especially among a wide range of resource disciplines. When used with the accompanying map, and perhaps paired with the companion text that describes ecoregions (Bailey In Press), information in this document can be used to illustrate the nested relationship of ecosystems, ranging from global to local levels. A single resource classification, such as a soils or existing vegetation map, may not satisfy all the needs of all users, but an ecological classification will come very close.

Chapter 1

Province 124–Arctic Tundra

One Section has been delineated in this Province: 124A–Coastal Plain. The area of this Section, located in northern Alaska, is about 19,100 mi² (49,500 km²).

Section 124A–Coastal Plain

Geomorphology. A relatively smooth plain that gradually ascends from the Arctic Ocean to the adjacent Brooks Range foothills. The area is mantled with Quaternary deposits of alluvial, glacial, and aeolian origin. Permafrost-related terrain features mark local surfaces (e.g., pingos, ice-wedge polygons, frost boils). Small sand dunes irregularly occur along the coast. Essentially, the area is a gently rolling to level, treeless plain with many lakes and rivers. Elevation is less than 660 ft (200 m).

Lithology and Stratigraphy. Occurs entirely within the North Slope subterranean consisting of basin deposits of Permian to lower Mesozoic age; marine and continental deposits of Tertiary age and older. The origin of the deep sediments is thought to be continental shelf deposits from the floor of the Beaufort Sea.

Soil Taxa. The dominant soils are Aquepts, primarily Histosol Pergelic Cryaquepts and Pergelic Cryaquepts.

Potential Natural Vegetation. Wet tundra communities dominated by sedges, rushes, mosses, lichens, and willows.

Fauna. Many species of waterfowl nest in the numerous lakes and ponds of the Arctic coastal plain. Brant and common eider are prevalent in this area. Seabirds such as the pomarine jaeger, glaucous gull, and black guillemot

are characteristic breeders. The semipalmated sandpiper is a common breeder in this section. The breeding range of the rare curlew sandpiper is limited to the tundra adjacent to the coast. The musk ox was extirpated in the 1850's and 1860's. Reintroduction efforts began in 1969. Characteristic mammalian predators include Arctic foxes throughout the Section and polar bears in the vicinity of the coast. Pink and chum salmon are present in this section but in limited numbers; this represents the northern limit of their range.

Climate. Average annual precipitation ranges from 4 to 6 in (100 to 150 mm). Average annual temperature ranges from 8 to 14 °F (-13 to -10 °C). In general, the growing season is from about June 15 to August 1. Frosts may occur in any month.

Surface Water Characteristics. Lakes, ponds, and streams make up more than 20 percent of the area. Streams originate in the highlands to the south; most of the smaller ones dry up or freeze completely during the winter. All soils are underlain by permafrost and are usually saturated throughout the summer. Wetlands occupy over 82 percent of the area.

Disturbance Regimes. Disturbance from wildfire is low.

Land Use. Most development is related to oil and gas extraction. Agriculture is severely limited by climate.

Cultural Ecology. Villages are primarily occupied by Inupiaq Eskimos.

Compiled by Alaska Region.

Province 125–Bering Tundra (Northern)

Two Sections have been delineated in this Province: 125A–Kotzebue Sound Lowlands and 125B–Yukon-Kuskokwim Delta. These Sections, located in western Alaska bordering the Bering Sea, include the islands of St. Lawrence, St. Matthew, and Nuiak. The area of these Sections is about 46,900 mi² (121,500 km²).

Section 125A–Kotzebue Sound Lowlands

Geomorphology. Flat, poorly drained coastal plains dominated by terraces, low hills, stabilized and active dune fields. The many thaw lakes and sinks are connected by a maze of waterways. Pingos are abundant in the lowland around the Selawik River. Elevation is less than 330 ft (100 m).

Lithology and Stratigraphy. Most of the area is underlain by morainal, stream, or lake deposits of unknown thickness. End moraines of pre-Wisconsin glacial advances are common. Cenozoic and Cretaceous marine sedimentary rocks prevail.

Soil Taxa. Soils are wet and shallow to permafrost. Dominant soils are Histic Pergelic Cryaquepts and Pergelic Cryofibrists. Soils are formed from stratified silty or sandy alluvial deposits, as well as volcanic ash and loess.

Potential Natural Vegetation. Since standing water is almost always present, wet tundra communities consisting of sedge mats predominate. Peat ridges, drainage ways, and polygonal features provide better drainage upon which woody plants like white spruce, willows, alder, and paper birch occur. Black spruce forests are abundant along the Kobuk River, whereas grasses grow on the dunes along the coast.

Fauna. Spectacled eiders, ruddy turnstones, and black turnstones are common breeding birds in the lowland tundra portions of this Section. The rare Arctic loon breeds only in western Alaska and is characteristic of this area. The snowy owl is the major avian predator and, with the Arctic fox, preys on populations of Alaskan hares. Polar bears extend into this Section from the Arctic Tundra Province. Wood frogs have been recorded east of Kotzebue Sound. This Section is the most northern range of king, sockeye, and silver salmon. Chum salmon runs in the Noatak and Kobuk Rivers provide substantial commercial and subsistence harvests. Sheefish in the Kobuk-Selawik river systems are the slowest growing, longest lived, and largest of Alaska sheefish.

Climate. Average annual precipitation ranges from 7 to 12 in (180 to 300 mm). Average annual temperature

ranges from 20 to 23 °F (-7 to -5 °C). The growing season is approximately from June 1 to September 15.

Surface Water Characteristics. Lakes and ponds make up 15 to 20 percent of the area. Soils underlain by permafrost are nearly always saturated in the summer. Permafrost is deep or absent and soils are well drained in natural levees and sand dunes. Spring flooding along rivers and tidal inundation along the coasts are common. Wetlands occupy 76 percent of the area.

Disturbance Regimes. Riparian disturbance is prevalent during spring break-up and summer storms that cause flooding in surrounding lowlands.

Land Use. Isolated human disturbance occurs around small permanent and seasonal settlements scattered throughout the Section, particularly along the coastline and larger rivers.

Cultural Ecology. Inupiaq Eskimos reside here.

Compiled by Alaska Region.

Section 125B–Yukon-Kuskokwim Delta

Geomorphology. The area is a lake-dotted marshy plain with many low hills of basalt and volcanic cinder cones and craters. Elevation is less than 400 ft (120 m).

Lithology and Stratigraphy. The lowland is underlain by post-accreted Quaternary sands and silts to unknown depth. Basalt flows and cinder cones of Tertiary and Quaternary age exist. Other bedrock consists of Cenozoic sedimentary rocks with inclusions of various other assemblages.

Soil Taxa. Dominant soils are Histic Pergelic Cryaquepts and Pergelic Cryofibrists. Soils are shallow over permafrost and consistently wet.

Potential Natural Vegetation. Wet tundra communities consisting primarily of sedge mats, moss, and low growing shrubs predominate. Alder, willows, and scattered, stunted spruce and birch grow along the major streams.

Fauna. The lakes, streams, and tidal flats interspersed with tundra and sedge flats make this Section exceptional habitat for waterfowl, shorebirds, and furbearers. The Yukon-Kuskokwim Delta supports the highest densities of nesting tundra swans, most of the world's population of emperor swans, and one-half of the total population of black brant. All of North America's cackling Canada



The Ingakslugwat Hills north of Baird Inlet.

geese are produced in these coastal lowlands. Spectacled eiders are common north of the Kuskokwim River. The only known breeding grounds of the very rare bristle-thighed curlew extend through this Section. Although rare, white wagtails are characteristic breeders in open areas along the coast. Dovekies and McKay's buntings are limited in Alaska to off-shore islands included in this Section. River otters are abundant; short-tailed and least weasels are common. Ribbon seals are characteristic of areas off-shore. Large numbers of barren-ground caribou inhabited this Section up until the mid-1800's. Limited numbers of caribou associated with herds from other Sections now occur in this area. The musk ox was introduced to Nunivak Island in 1935 and 1936. Wood frogs have been reported from the eastern portion of this Section. All three forms of Arctic char (anadromous, resident stream, resident lake) occur here. Sheefish are associated with both the Yukon and Kuskokwim rivers. All five species of North American Pacific salmon are indigenous to this Section; chum salmon are the most abundant.

Climate. Average annual precipitation ranges from 15 to 22 in (380 to 560 mm). Average annual temperature ranges from 25 to 31 °F (-4 to -1 °C). The growing season is approximately from June 1 to September 15.

Surface Water Characteristics. The lowland is crossed by meandering streams of extremely low gradient. Many are tributaries or former channels of the Yukon or Kuskokwim Rivers. Wetlands occupy over 78 percent of the area.

Disturbance Regimes. Occurrence of wildfires is low.

Land Use. Only small permanent and seasonal settlements occur along the rivers and coast. The region is used for subsistence and recreational hunting and fishing.

Cultural Ecology. Yupik Eskimos reside in this Section.

Compiled by Alaska Region.

Chapter 3

Province 126–Bering Tundra (Southern)

One Section has been delineated in this Province: 126A–Bristol Bay Lowlands. This Section, located in southwestern Alaska, includes part of the Alaska Peninsula. Its area is about 23,600 mi² (61,100 km²).

Section 126A–Bristol Bay Lowlands

Geomorphology. This Section is a flat-to-rolling moraine and outwash-mantled lowland. The source of the material is from surrounding glaciated mountains. Elevation is generally less than 500 ft (150 m).

Lithology and Stratigraphy. The lowland is underlain by several hundred feet of outwash and morainal deposits that are mantled in part by silt and peat. Outwash deposits are coarse near the mountains and grade to fine sand along the coast. A small area of low stabilized and active dunes lies east of the Nushagak River.

Soil Taxa. Dominant soils are Typic Haplocryands, Fluvaquentic Cryofibrists, Typic Vitricryands, Histic Pergelic Cryaquepts, Pergelic Cryaquepts, and Typic Cryochrepts. Most soils formed in ash deposits of various thickness underlain by gravelly glacial till, outwash deposits, or silty alluvium. Coastal plain soils have gravelly alluvium, cinders, or weathered rock blanketed by thick sedge peat.

Potential Natural Vegetation. Moist and wet tundra meadows are the dominant vegetation. Mosses, sedges, and low growing shrubs cover most of the area. Alder and willows and, in scattered places, stunted spruce and birch grow along the major rivers and streams.

Fauna. Bristol Bay provides staging and migration habitat for large numbers of waterfowl. Ospreys occur more frequently in this Section than in other areas of Alaska. Blackpoll warblers are common breeders in conifer stands in the northern portion. Brown bears are common, partially in response to the large salmon runs in this area. Bristol Bay supports the largest run of sockeye salmon in the world. Rainbow trout are a common resident fish in the northern part of this Section.

Climate. Average annual precipitation ranges from 18 to 32 in (460 to 810 mm). Average annual temperature ranges from 30 to 37 °F (-1 to 3 °C). The growing season is approximately from May 15 to September 10.

Surface Water Characteristics. Morainal and thaw lakes and ponds are scattered throughout the lowlands and make up about 15 percent of the Section. Most streams arise from the nearby mountains, and many have headwaters comprised of lakes in ice-carved basins. Permafrost is limited to isolated masses. Wetlands occupy 55 percent of the area.

Disturbance Regimes. The occurrence of wildfires is low.

Land Use. Permanent settlements occur primarily along the coast or adjacent to the larger rivers.

Cultural Ecology. Yupik and Alutiiq Eskimos occupy the northern and southern portions of this Section, respectively.

Compiled by Alaska Region.

Chapter 4

Province M121–Brooks Range Tundra - Polar Desert

Two Sections have been delineated in this Province: M121A–Foothills and M121B–Mountains. They are in northern Alaska, north of the Arctic Circle. The area of these Sections is about 101,600 mi² (263,100 km²).

Section M121A–Foothills

Geomorphology. In the northern portion, rock folding and unequal erosion have produced a linear-ridge topography. The sedimentary rocks of the southern portion are tightly folded and form irregular buttes, mesas, and long linear ridges. Hummocky morainal ridges border most north-south valleys. Ice-related features are common (e.g., pingos, solifluction lobes, ice-wedge polygons, stone stripes). The area consists of maturely dissected low hills and ridges that have never been glaciated. Elevation is mainly less than 1,970 ft (600 m).

Lithology and Stratigraphy. The entire area lies within the North Slope-Endicott Mountain subterranean, consisting of shale, conglomerate, carbonate, and deep shelf marine rocks of Permian to lower Mesozoic age. The origin of the deep sediments is thought to be the floor of the Beaufort Sea.

Soil Taxa. The dominant soils are Aquepts that have a pergelic temperature regime, mainly Pergelic Cryaquepts, Histic Pergelic Cryaquepts and Pergelic Ruptic-Histic Cryaquepts.

Potential Natural Vegetation. Moist tundra-cottongrass tussocks are interspersed with willow-dominated communities along river corridors.

Fauna. Moist tundra communities provide nesting habitat for several species of sandpiper (e.g., Baird's, stilt, and buff-breasted) and small mammals such as the insular vole. Willow ptarmigan and Alaskan hare inhabit the scattered patches of birch, alder, and willow. Predators include rough-legged hawks, peregrine falcons, gyrfalcons, snowy owls, and Arctic foxes. Wood frogs have been reported north of the Brooks Range. Arctic char and Arctic grayling are found in most rivers and some of the shallow tundra lakes.

Climate. Average annual precipitation ranges from 6 to 10 in (150 to 250 mm). Average annual temperature ranges from 9 to 20 °F (-13 to -7 °C). The growing season is generally from June 15 to August 1; however, frosts may occur in any month.

Surface Water Characteristics. Many swift streams and rivers occur among the hills, but lakes are infrequent. Most streams have swift, braided courses across gravel

flats. Streams often freeze solid to their bottoms, causing floods to occur over the surrounding flats. The entire area is underlain by permafrost; consequently, soils are fairly wet. Some thaw lakes are present. Wetlands occupy greater than 83 percent of the area.

Disturbance Regimes. Occurrence of wildfire is very low.

Land Use. Climate and soils are unsuitable for agriculture. Subsistence hunting and fishing is present. There is limited petroleum extraction.

Cultural Ecology. Inupiaq Eskimos reside in this section.

Compiled by Alaska Region.

Section M121B–Mountains

Geomorphology. Rugged, deeply dissected, east-west trending mountains having rounded-to-sharp summits. Abrupt mountain fronts frequently face northward. Small cirque glaciers occur only on the highest peaks of the Brooks Range. Elevation ranges from 1,640 to 8,530 ft (500 to 2,600 m).

Lithology and Stratigraphy. The area is composed of segments of Endicott Mountain, the North Slope, and Delong Mountain subterranean and the Hammond terrane. These are continental fragments, some of which have been faulted, folded and metamorphosed.

Soil Taxa. The dominant soils are Entisols and Inceptisols that form in a pergelic temperature regime, specifically Lithic Cryorthents, Pergelic Cryaquepts, and Pergelic Cryumbrepts.

Potential Natural Vegetation. Many of the highest ridges are barren or ice-covered. Alpine tundra heath communities occur on upper and intermediate slopes, whereas moist tundra sedge-tussock meadows with occasional trees prevail on lower slopes. Shrub thickets occur along river corridors.

Fauna. Golden eagles inhabit the expansive subalpine mountain valleys and alpine tundra of this Section. Horned larks, Smith's longspurs, and insular voles are characteristic inhabitants of the wide valley floors. Dall sheep occur in the alpine zone. Ground water springs and associated Arctic rivers of the Brooks Range support populations of Arctic char.



The glacially eroded De Long Mountains of the western Brooks Range.

Climate. Average annual precipitation ranges from 6 to 13 in (150 to 330 mm). Average annual temperatures varies from 10 to 22 °F (-12 to -6 °C). The growing season generally extends from June 15 to August 1. Freezing temperatures may occur in any month.

Surface Water Characteristics. Several glacially-carved lakes are at the northern and southern peripheries. Most streams and rivers flow through narrow ravines with steep headwalls and together form a broad dendritic pattern. All soils, except for a few south-facing slopes, are underlain by permafrost. Wetlands occupy at least 20 percent of the area.

Disturbance Regimes. Wildfire is a fairly common disturbance event.

Land Use. The area is largely undisturbed by humans, except for occasional subsistence use during summer months.

Cultural Ecology. Inupiaq Eskimos reside in the west and the Kutchin Athabaskan Mountains in the east.

Compiled by Alaska Region.

Chapter 5

Province M125–Seward Peninsula Tundra - Meadow

One section have been delineated in this Province: M125A–Seward Mountains. Located in northwestern Alaska along the Bering Sea, it includes much of the Seward Peninsula and part of St. Lawrence Island. The area of this Section is about 20,600 mi² (53,400 km²).

Section M125A–Seward Mountains

Geomorphology. The area consists mainly of extensive uplands of broad convex hills and flat divides indented by sharp V-shaped valleys. Isolated groups of glaciated mountains and peaks cover the higher elevation areas. Elevation ranges from sea level to 4,600 ft (1,400 m).

Lithology and Stratigraphy. The entire section lies within the Seward terrane that consists of metamorphosed mica and calcareous schists, marbles, gneissic, and other metavolcanic rocks of Paleozoic age.

Soil Taxa. Soils are predominantly Histic Pergelic Cryaquepts, Pergelic Cryaquepts, Typic Cryochrepts, Lithic Cryorthents, and Pergelic Cryumbrepts. Soils generally are poorly drained and shallow over permafrost. On hillslopes and ridges, soils are formed in very gravelly residual material over weathered bedrocks. At lower elevations, they are formed mainly in colluvial and alluvial sediments.

Potential Natural Vegetation. Vegetation patterns consist of moist tundra sedge-tussock meadows at lower elevations, interspersed with scattered willows, birch, and isolated spruce-hardwood forests, particularly along rivers. Alpine tundra heath meadows and barrens dominate the high mountains.

Fauna. Spectacled eiders, ruddy turnstones, and black turnstones are common breeding birds in the lowland tundra portions of this Section. The rare Arctic loon,



Granite talus on the slopes of Cape Mountain on the western tip of the Seward Peninsula. The village of Cape Prince of Wales is on the left.

which breeds only in western Alaska, is characteristic of this area. Yellow wagtails inhabit willow thickets on the tundra, and white wagtails nest in open areas along the coast. The only known breeding grounds of the very rare bristle-thighed curlew extend through this Section. Arctic foxes and Alaskan hares are common; polar bears are often observed. Ribbon seals are characteristic off-shore areas. Reindeer were introduced from 1891 to 1902 to provide an additional food source for the resident human population. Musk oxen were introduced in 1970 as a potential game animal. Chum salmon are the most numerous of the five salmon species in this area. Sheefish and Arctic char are common in near-shore saltwater and in area streams.

Climate. Average annual precipitation ranges from 10 to 16 in (250 to 400 mm). Average annual temperature ranges from 21 to 26 °F (-6 to -3 °C). The growing season is approximately from June 1 to September 15.

Surface Water Characteristics. Streams occupy all the larger valleys. Many inland lakes and small coastal lakes and ponds exist. Most of the area is underlain by permafrost. Wetlands occupy 53 percent of the area.

Disturbance Regimes. Occurrence of wildfires is common, particularly from June through August. Mosses and lichens dry during summer, allowing fire to spread through the tundra.

Land Use. Population is low and dispersed. The largest settlement is Nome, where subsistence and recreational hunting and fishing are concentrated. Numerous mines are scattered throughout the section.

Cultural Ecology. This is the historic range of Inupiaq Eskimos.

Compiled by Alaska Region

Chapter 6

Province M126—Ahklun Mountains Tundra - Meadow

One Section has been delineated in this Province:
M126A—Ahklun Mountains. It is located in southwestern Alaska, bordering the Bering Sea. The area of this Section is about 16,700 mi² (43,300 km²).

Section M126A—Ahklun Mountains

Geomorphology. A group of rugged steep-walled mountains having sharp summits separated by broad, flat valleys and lowlands. This Section includes the Pribilof Islands. Elevation ranges from sea level to greater than 4,920 ft (1,500 m).

Lithology and Stratigraphy. The area occurs within the Togiak terrane, consisting of late Mesozoic island arc and deep ocean volcanic rocks. These rocks are cut by great northeast-trending faults, along which many of the valleys have been eroded by glacial ice.

Soil Taxa. Principal soils are Histic Pergelic Cryaquepts, Pergelic Cryaquepts, Typic Cryochrepts, Humic Cryorthods, Pergelic Cryorthods, Typic Cryumbrepts, and Pergelic Cryumbrepts. Mountain soils formed in very stony and gravelly colluvium material over bedrock, whereas valley soils formed in glacial till.

Potential Natural Vegetation. Alpine tundra heath meadows and barrens predominate in the mountains, whereas moist tundra sedge-tussock meadows occur in valley bottoms. Black spruce forest vegetation dominates some hills and ridges. Forests of white spruce, paper birch, and alder cover the low hills along the major rivers.

Fauna. Blackpoll warblers are common breeders in conifer stands in river valleys. Beaver are abundant, supporting a large annual harvest. Wood frogs have been reported to occur. Sockeye salmon are the most abundant fish. Chum, king, and silver salmon are also numerous. Rainbow trout are a common resident fish in this Section.

Climate. Average annual precipitation ranges from 19 to 25 in (480 to 640 mm). Average annual temperature ranges from 29 to 33 °F (-2 to 1 °C). The growing season extends approximately from May 15 to September 10.



North of Nondalton, mountain foot slopes and moraine hills mantled by volcanic ash.

Surface Water Characteristics. Water is adequate to abundant in most of the area, but may be deficient in midsummer in the northern portion. Permafrost exists in most low-lying soils and in high mountains, but it is generally absent in soils covered by forests. Wetlands occupy up to 55 percent of the area.

Disturbance Regimes. Occurrence of wildfires is low.

Land Use. Human population is low and dispersed. Recreational and subsistence hunting and fishing are the main uses.

Cultural Ecology. Yupik Eskimos reside here.

Compiled by Alaska Region.

Province M127–Aleutian Oceanic Meadow - Heath

Three Sections have been delineated in this Province: M127A–Alaska Peninsula; M127B–Aleutian Islands; and M127C–West Kodiak Island. These Sections are located in southwestern Alaska, and, as their names describe, include the Alaska Peninsula, Aleutian Islands, and part of Kodiak Island. The area of these Sections is about 22,200 mi² (57,500 km²).

Section M127A–Alaska Peninsula

Geomorphology. The Aleutian Range consists of rounded east-trending ridges surmounted at intervals by rugged volcanoes. The mountains were heavily glaciated during the Pleistocene epoch. This Section is bordered to the north by the Bristol Bay Lowlands where the Aleutian Mountains become increasingly submerged southwestwardly forming the Aleutian Islands. Elevation ranges from sea level to 8,530 ft (2,600 m).

Lithology and Stratigraphy. The Aleutian Mountains consist of segments of the peninsular terrane, which includes mildly folded and faulted late Mesozoic sedimentary rocks, locally intruded by granitic rocks and surmounted at intervals by volcanic piles dating from the late Tertiary to the recent age. Many volcanoes have calderas. A major fault extends along the north side of the eastern part of the range, separating the sedimentary rocks from the granitic batholith on the north.

Soil Taxa. Dominant soils are Typic Haplocryands and Typic Vitricryands. Most of the glacial deposits are mantled with volcanic ash and scoria and are very easily eroded. Soils are shallow on mountain peaks, rock escarpments, and colluvial slopes. Some depressions are filled with fibrous peat.

Potential Natural Vegetation. The vegetation is primarily alpine tundra heath meadows and barrens, with willow and alder occurring at lower elevations and along drainages.



View from Aniakhak caldera, which contains spectacular examples of almost every kind of recent volcanic activity. Vent Mountain, a cinder cone rising 2,200 ft above the floor, is seen in the center of the caldera.

Fauna. The Alaska Peninsula provides significant staging and migration habitat for waterfowl in the spring and fall. Numerous Steller sea lion rookeries and hauling grounds occur along the coast. Sea otters are also common along the coast. Large populations of brown bears live here, partially in response to the large salmon runs which are dominated by pink, chum, and silver salmon.

Climate. Average annual precipitation ranges from 24 to 65 in (610 to 1,650 mm). Average annual temperature ranges from 33 to 40 °F (1 to 4 °C). The growing season lasts approximately from May 10 to September 30 in low-lying areas. Killing frosts can occur any day of the year at higher elevations.

Surface Water Characteristics. Glacially fed streams flowing to the Pacific are short and steep, while those flowing to the Bering Sea are longer and have braided channels. Many lakes occur along the northern portion, held in by end moraines; many lake bottoms extend well below sea level. Wetlands occupy less than 3 percent of the area.

Disturbance Regimes. Ocean-spawned storms rack coastal areas with high wind and heavy rains.

Land Use. Human occupation is restricted to the shorelines. The region is primarily used for subsistence and recreational hunting and fishing.

Cultural Ecology. Aleuts inhabit the west and the Alutiiq Eskimos occupy the east.

Compiled by Alaska Region.

Section M127B—Aleutian Islands

Geomorphology. The Aleutian Islands are made up of a chain of volcanic islands perched atop the crest of a submarine ridge. Topography varies from wave-beaten level platforms near sea level to intensely glaciated mountains indented with fjords and bordered by cliffs. The islands gradually emerge above sea level to the northeast forming the Alaska Peninsula. Elevation rises from sea level to greater than 6,230 ft (1,900 m).

Lithology and Stratigraphy. The linear chain of volcanoes on the north side of the islands is of late Cenozoic age and includes many calderas. The remainder of the islands appear to be emerged parts of tilted fault blocks, consisting chiefly of faulted and folded Cenozoic volcanic rocks, which include locally mildly metamorphosed as well as granitic intrusions of Cenozoic age. The submarine topography of the Aleutian Ridge reveals to be complexly block faulted along its crest.

Soil Taxa. Dominant soils are Typic Haplocryands and Typic Vitricryands. Most soils formed in deposits of volcanic ash or scoria over basaltic bedrock. Bare rock and rubble occur on the steep slopes of volcanic cones, peaks, and high ridgetops. With increasing distance from active volcanoes, volcanic material generally grades from coarse lapilli and scoria to fine sands. Organic soils occupy depressions and some broad valley bottoms.

Potential Natural Vegetation. Vegetation consists of alpine tundra heath meadows. Lichen communities prevail on windswept ridges. Moist tundra meadows occur at lower elevations and are dominated by grass, sedge, and scattered willows and birch.

Fauna. This Section is rich in bird life and marine mammals, but has few large land mammals. Several species of auklet (i.e., Cassin's, crested, least, and parakeet) are common breeders. The whiskered auklet is an uncommon breeder but occurs only in this Section in Alaska. Red-legged kittiwakes are also unique to this Section, nesting mainly on Buldir and Bogoslof Islands. The entire population of the endangered Aleutian Canada goose nests here. Nearly all of the world's population of Emperor geese winter in the Aleutians. Winter wrens and rosy finches are common breeders along rocky beaches. The introduction of foxes, rats, cats, and dogs resulted in severe reductions of ground-nesting birds. Northern fur seal rookeries are used for breeding and pupping. Numerous Steller sea lion rookeries and hauling grounds occur along the coast. Sea otters also are common along the coast. Sockeye and pink salmon are the most numerous fish species in this Section.

Climate. Average annual precipitation ranges from 32 to 65 in (810 to 1,650 mm). Average annual temperature ranges from 36 to 39 °F (2 to 4 °C). The growing season extends approximately from June 1 through September 15.

Surface Water Characteristics. Streams in the Aleutian Islands are short and swift. Many plunge into the sea over waterfalls. Volcanoes of porous rock have stream courses that are filled with water only during exceptionally heavy rains. Many lakes occupy irregular ice-carved basins in rolling topography on glaciated islands. Numerous ponds were enlarged when ice, expanded by freezing, shoved the banks aside to form ramparts of soils and turf. Lakes fill a few volcanic craters and calderas. Wetlands occupy 11 percent of the area.

Disturbance Regimes. These islands are frequently affected by intense storms, spawning high winds and heavy rains.

Land Use. Settlements are sparse and restricted to the coastline. The region is used primarily for subsistence and recreational hunting and fishing. Native plant communities have been negatively affected by the introduction of exotic species.

Cultural Ecology. Aleuts occupy this Section.

Compiled by Alaska Region.

Section M127C–West Kodiak Island

Geomorphology. The Kodiak Mountains are mostly glaciated, with broad smooth ridges that extend northwestward. The coastline is extremely irregular, having many fjords and islands. The western part of the island has many broad U-shaped valleys. Elevation ranges from sea level to 4,270 ft (1,300 m).

Lithology and Stratigraphy. Kodiak Island occurs within the Chugach terrane and is comprised of complexly deformed, weakly metamorphosed Upper Cretaceous graywacke and slate, with disrupted assemblages of chert, gabbro, ultramafic rocks, and basalt. Older greenstones and schist lie along the northwest coast. The main divide is granitic batholith. Northeast-trending belts of downfaulted and eroded Tertiary rocks lie on the southeast side and make up the Trinity Islands. With the occurrence of moraines and ice margin ridges, it appears that ice from the Alaska Peninsula Section banked up against the western shore of the West Kodiak Island Section.

Soil Taxa. Dominant soils are Typic Haplocryands and Typic Vitricryands. Most of the glacial deposits are mantled with ejecta from the 1912 eruption of Mount Katmai and Novarupta. Soils are shallow on mountain peaks, rock escarpments, and colluvial slopes. Some depressions are filled with fibrous peat.

Potential Natural Vegetation. The vegetation is primarily alpine tundra heath meadows and barrens with moist and wet sedge meadows occurring at lower elevations. Shrub thickets occur along some drainages.

Fauna. Saltwater bays provide habitat for Aleutian terns and harlequin ducks. Shoreline rocks and cliffs support black-legged kittiwakes, horned and tufted puffins, black oystercatchers, and common murre. The Kodiak brown

bear is the world's largest carnivore. Five other land mammals are native to the island: red fox, river otter, short-tailed weasel, little brown bat, and tundra vole. Successful introductions of other land mammals include Sitka black-tailed deer (1924-34), beaver (1925), snowshoe hare (1934), and mountain goat (1952-53). Steller sea lions are common in coastal waters around Kodiak Island. All five species of North American Pacific salmon are present in the Kodiak area; pink, chum, and sockeye are the most abundant. Arctic char are the most widely distributed resident or anadromous fish on Kodiak Island. Other native species include steelhead and rainbow trout.

Climate. Average annual precipitation ranges from 50 to 70 in (1,270 to 1,780 mm). Average annual temperature ranges from 38 to 41 °F (3 to 5 °C). The growing season lasts approximately from May 10 to September 30 in low-lying areas. Killing frosts can occur any day of the year at higher elevations.

Surface Water Characteristics. Glacially fed streams are short and steep and many are less than 10 miles long. Lakes and ponds are scattered over the glacially sculptured landscapes. Wetlands occupy less than 11 percent of the area.

Disturbance Regimes. Storm events are the primary source of natural disturbance. Wildfires are rare.

Land Use. Human occupation is restricted to the shorelines, with the city of Kodiak having the highest population. The region is primarily used for subsistence and recreational hunting and fishing.

Cultural Ecology. Alutiiq Eskimos presently occupy this Section.

Compiled by Alaska Region.

Province 131–Yukon Intermontane Plateaus Tayga

Two Sections have been delineated in this Province: 131A–Upper Kobuk Valley and 131B–Yukon-Kuskokwim Bottomlands. These Sections are located in central Alaska; their area is about 56,100 mi² (145,300 km²).

Section 131A–Upper Kobuk Valley

Geomorphology. Diverse topography which includes scattered groups of hills and low mountains surrounded by irregular lowlands and broad flat divides. Elevation ranges from 1,300 to 3,940 ft (400 to 1,200 m).

Lithology and Stratigraphy. Most of the section consists of alluvial fan and basin deposits of later Mesozoic to Quaternary age. The Koyukuk terrane, consisting of island arc volcanic and volcanoclastic rocks, occupies the southwest corner of the Section.

Soil Taxa. The dominant soils are Aquepts and Ochrepts, formed in a cryic or pergelic temperature regime.

Potential Natural Vegetation. Closed forests of spruce, birch, and aspen occur on moderately drained to well drained sites. In wetlands, open black spruce forests are often interspersed with willow thickets and treeless bogs.

Fauna. The lakes and wetlands associated with the Kobuk, Koyukuk, and Selawik Rivers support breeding populations of common loons, horned grebes, and red-necked grebes. Beaver and snowshoe hare are common. Lynx occur along the Koyukuk River. Northern pike are found in this Section. Sheefish and chum salmon are common in the Kobuk and Selawik Rivers. Wood frogs have been reported.

Climate. Average annual precipitation ranges from 12 to 14 in (300 to 360 mm). Average annual temperature ranges from 16 to 24 °F (-9 to -4 °C). The growing season lasts approximately from May 15 through September 10.

Surface Water Characteristics. The Kobuk River and tributaries of the Upper Koyukuk River drain the area. Numerous thaw lakes dot valleys and broad flats. Wetlands occupy 39 percent to 76 percent of the area.

Disturbance Regimes. Most wildfires, which occur frequently, are ignited by lightning strikes.

Land Use. Primary human uses are subsistence and recreational hunting and fishing.

Cultural Ecology. The Inupiaq Eskimos are the principal residents of this Section.

Compiled by Alaska Region.

Section 131B–Yukon-Kuskokwim Bottomlands

Geomorphology. This Section represents a collection of flat bottomlands along the larger rivers of interior Alaska. Although nearly level, broad valleys and basins are typical, some low rolling hills and piedmont slopes do occur. Riparian features, such as meandering streams and side sloughs, are prevalent. Oxbow, thaw, and morainal lakes are abundant. Elevation generally ranges from 400 ft (120 m) in the west to 1,640 ft (500 m) in the east.

Lithology and Stratigraphy. Alluvial fan and basin fill of late Tertiary and Quaternary age are most common. This Section is underlain mainly by postaccreted Cenozoic deposits and various terranes.

Soil Taxa. The dominant soils are Aquepts that have pergelic temperature and aquic moisture regimes. Specifically, Histic Pergelic Cryaquepts, Pergelic Cryaquepts, Aquic Cryochrepts, Typic Cryochrepts, and Typic Cryofluvents predominate. Most soils were formed by loess and alluvial materials.

Potential Natural Vegetation. Dominant vegetation communities span a moisture gradient from mesic to hydric and include spruce-poplar forests, open black spruce forests, floodplain thickets of willow and alder, and graminoid marsh.

Fauna. The lakes and wetlands associated with the Yukon and Kuskokwim Rivers support breeding populations of common loons, horned grebes, red-necked grebes, and common goldeneyes. Ruffed grouse, belted kingfishers, alder flycatchers, and Hammond's flycatchers also frequently breed in the forests of these river valleys. The best habitat in interior Alaska for furbearers such as mink, marten, muskrat, and river otter occurs in this Section. Red squirrels, northern bog lemmings, and yellow-cheeked voles also occur. The Yukon and Kuskokwim Rivers and their tributaries support northern pike, sheefish, chum salmon, and king salmon.

Climate. Average annual precipitation ranges from 10 to 24 in (250 to 610 mm). Average annual temperature ranges from 22 to 30 °F (-6 to -1 °C). The growing season is approximately from May 15 to September 10. The average freeze-free period is 70 to 120 days.

Surface Water Characteristics. Surface water in streams, lakes, and bogs is abundant in most of the area. Permafrost is widespread but discontinuous. Soils are poorly drained where permafrost exists. Wetlands occupy up to 61 percent of the area.

Disturbance Regimes. Wildfire is a very common event, averaging about 2,260 ha in size. A high frequency of lightning storms, coupled with prevailing warm and dry summers, promote fire occurrence. River flooding is frequent, particularly in the spring.

Land Use. Primarily interior settlements and agriculture occur in this Section. Subsistence and recreational hunting and fishing are popular.

Cultural Ecology. Residents are mainly Koyukon, Tanana, and Kuskokwim Athabaskans.

Compiled by Alaska Region.

Province 135–Coastal Trough Humid Tayga

Two Sections have been delineated in this Province: 135A–Cook Inlet Lowlands and 135B–Copper River Basin. The area of these Sections, which are located in south-central Alaska, is about 15,700 mi² (40,700 km²).

Section 135A–Cook Inlet Lowlands

Geomorphology. A level-to-rolling surface derived mainly through glacial events (ground moraine, drumlin fields, eskers, and outwash plains). Elevation ranges from sea level to 500 ft (150 m).

Lithology and Stratigraphy. Alluvial fan and uplifted continental shelf deposits of Tertiary age dominate.

Soil Taxa. Soils are fairly diverse and include Haplocryands, Andic Haplocryods, and Andic Humicryods. Sphagnic Borofibrists, Terric Borosapristis, and Typic Borochemists occur in poorly drained depressions.

Potential Natural Vegetation. Lowland black spruce forests are abundant. Bottomland spruce-poplar forests are adjacent to larger river drainages, along with thickets of alder and willow. Some wet tundra communities exist along the Cook Inlet coastline.

Fauna. The diversity of habitats in this Section results in the presence of a large number of species. Trumpeter swans nest in the Kenai Peninsula. During migration, tundra swans occur throughout the Section. The Cook Inlet Lowlands are within the range of the pigmy shrew and northern water shrew in Alaska. Muskrats and red foxes are abundant in the northern portion of this Section. Red squirrels are abundant on the Kenai Peninsula. Moose are numerous in the lowland portions and Dall sheep are frequently seen in the uplands. Caribou were extirpated on the Kenai Peninsula about 1913 and were reintroduced in the mid 1960's. Black bear populations are dense throughout the Section. King, sockeye, and silver salmon are common to abundant. Wood frogs have been reported here. Dolly Varden and white fish occur in fresh waters throughout the Section.

Climate. Average annual precipitation ranges from 12 to 32 in (300 to 810 mm). Average annual temperature ranges from 27 to 37 °F (-3 to 3 °C). The growing season extends from approximately May 10 to September 30. Average freeze-free period is 110 to 150 days.

Surface Water Characteristics. Numerous small lakes and depressional bogs occur in areas of stagnant ice topography and on ground moraines. The Section is generally free of permafrost. Wetlands occupy over 25 percent of the area.

Disturbance Regimes. Wildfire occurrence is low.

Land Use. This section is heavily populated, and substantially affected by agriculture, urban development, petroleum extraction, and human recreation.

Cultural Ecology. Historically occupied by Tanaina Athabaskans, a variety of cultures now reside in this heavily developed section.

Compiled by Alaska Region.

Section 135B–Copper River Basin

Geomorphology. The area is a broad basin of rolling-to-hilly moraines and nearly level alluvial plains that occupy the site of a Pleistocene glacial lake. Most rivers originate from glaciers located in the surrounding mountains. Elevation ranges from 1,380 to 2,950 ft (420 to 900 m).

Lithology and Stratigraphy. Post-accreted deposits of Tertiary and Quaternary age predominate (e.g., alluvial fan and upland basin fill).

Soil Taxa. Most soils are Aquepts, formed in pergelic temperature and aquic moisture regimes. Specifically, Histic Pergelic Cryaquepts, Aquic Cryochrepts, Typic Cryochrepts, Pergelic Cryaquolls, and Typic Cryoborolls predominate. Soils generally formed in clayey to silty glaciolacustrine sediments over gravelly glacial drift.

Potential Natural Vegetation. Open black spruce forests interspersed with large areas of brushy tundra characterize this Section. White spruce forests occur on south-facing, gravelly moraines, whereas cottonwood-tall bush communities are found on large floodplains.

Fauna. Ruffed grouse occur throughout the low elevation, forested habitats. The range of the Nelchina caribou herd encompasses this Section. For interior habitats, relatively high populations of black and brown bears for interior habitats live here. A comparatively high density of wolverines also occurs in this Section. Sockeye salmon is the major anadromous fish present; minor numbers of king salmon also occur. Arctic grayling and burbot are found in the lakes and streams throughout this Section.

Climate. Average annual precipitation ranges from 10 to 20 in (250 to 500 mm). Average annual temperature ranges from 26 to 30 °F (-3 to -1 °C). The growing season consists of approximately 10 weeks of frost-free days during the summer.

Surface Water Characteristics. The overall drainage pattern is poorly defined, except for lower stretches of larger rivers. Permafrost is discontinuous over the area and thaw lakes are numerous. Morainal and abandoned melt-water channel lakes are frequent. Soils above permafrost are wet or moist throughout the summer. Wetlands occupy 36 percent of the area.

Disturbance Regimes. Flooding is probably the most important naturally-occurring disturbance in the area. Wildfire frequency is low.

Land Use. The area is used primarily for subsistence and recreational hunting and fishing.

Cultural Ecology. Ahtna Athabaskans reside in this Section.

Compiled by Alaska Region.

Province 139–Upper Yukon Tayga

One Section has been delineated in this Province:
139A–Upper Yukon Flats. Located in east-central Alaska, the area of this Section is about 13,000 mi² (33,700 km²).

Section 139A–Upper Yukon Flats

Geomorphology. The Yukon Flats encompass gently sloping outwash fans and floodplains of the Chandalar, Christian, Sheenjek, and Upper Yukon Rivers. This Section is a relatively flat, marshy basin patterned by braided and meandering streams, numerous thaw and oxbow lakes, and meander scars. Elevation ranges from 300 to 820 ft (90 to 250 m).

Lithology and Stratigraphy. Postaccreted alluvial fan and basin fill deposits of late Tertiary and Quaternary age occur.

Soil Taxa. Principal soils are Histic Pergelic Cryaquepts, Pergelic Cryaquepts, Aquic Cryochrepts, and Pergelic Cryochrepts. Most soils formed from silty alluvium and loess deposits. Lower parts of the floodplain are poorly drained and covered with peat, whereas natural river levees are better drained.

Potential Natural Vegetation. Bottomland spruce-aspen-birch grow on the better drained alluvial sites. Alder and willow form thickets on newly exposed alluvial sites, which are subject to periodic flooding. The wettest sites have black spruce, willow, or graminoid marsh cover.

Fauna. The Yukon Flats may be the most productive Arctic habitat for wildlife on the continent. Predominant waterfowl species that breed in the Section are the lesser scaup, pintail, scoter, and widgeon. This area also

supports 15-20 percent of the diminished population of canvasbacks. Arctic, red-throated, and common loons, horned and red-necked grebes, and sandhill cranes are also common. The snowshoe hare and lynx may be abundant in this Section but experience population cycles. This area provides prime habitat for aquatic furbearers, including river otters, beaver, and muskrats. Wood frogs have been reported from this Section. King, silver, and chum salmon occur in the Yukon River and its tributaries. Resident fish include northern pike, sheefish, burbot, and Arctic grayling.

Climate. Average annual precipitation ranges from 7 to 13 in (180 to 330 mm). Average annual temperature ranges from 16 to 24 °F (-9 to -4 °C). The growing season generally lasts from May 15 to September 10; freezing can occur in any month however.

Surface Water Characteristics. Surface water in streams, lakes and bogs is usually abundant. Water levels of lakes are typically not maintained by precipitation, but rather by spring flooding. All poorly drained soils are underlain by perennially frozen ground. Wetlands occupy 38 percent of the area.

Disturbance Regimes. Wildfire occurrence is common in the Yukon Flats.

Land Use. The area is populated by several small villages. Subsistence and recreational hunting and fishing are the primary human uses.

Cultural Ecology. Koyukon and Kutchin Athabaskans occupy the western and eastern portions of the basin, respectively.

Compiled by Alaska Region.

Province M131–Yukon Intermontane Plateaus Tayga - Meadow

Three Sections have been delineated in this Province: M131A–Nulato Hills, M131B–Kuskokwim Mountains, and M131C–Nushagak-Lime Hills. The area of these Sections, located in central Alaska, is about 55,000 mi² (142,400 km²).

Section M131A–Nulato Hills

Geomorphology. The Nulato Hills generally consist of northeast-trending, even-crested ridges having rounded summits and gentle slopes. Valleys are narrow and flat-bottomed. Elevation ranges from sea level to 4,040 ft (1,230 m).

Lithology and Stratigraphy. The Section consists of Upper Cretaceous rocks with minor fragments of Koyukuk and Tozitna terranes.

Soil Taxa. The dominant soils are Aquepts that have a pergelic temperature regime. Cryaquepts occur on areas of impeded drainage underlain by permafrost. Cryumbrepts and Cryorthents are principal soils on high ridges and where surfaces drain well.

Potential Natural Vegetation. Most of the area supports alpine tundra vegetation of sedges and prostrate shrubs (e.g., willows). Barren areas are frequent at high elevations. Spruce-aspen-birch forests occur at lower elevations.

Fauna. Shrub thickets in the upland areas support breeding populations of bluethroats, yellow wagtails, and red-throated pipits. Surfbirds nest in the alpine tundra areas. River otters are found throughout the major river drainages. Wood frogs have been reported in this Section.

Climate. Average annual precipitation ranges to 12 to 16 in (300 to 400 mm). Average annual temperature ranges from 23 to 28 °F (-5 to -2 °C). The growing season is approximately from May 15 to September 10.

Surface Water Characteristics. Streams in the east flow to the Yukon River, whereas those of the west side flow towards Norton Sound. Following the prevailing topography, streams have parallel courses flowing either northeast or southwest. There are some thaw lakes in the valleys. Most of the Section is underlain by permafrost. Wetlands occupy up to 53 percent of the area.

Disturbance Regimes. Wildfires occur frequently.

Land Use. Subsistence and recreational hunting and fishing are the major human uses. Mining was formerly important.

Cultural Ecology. Residents include: Inupiaq Eskimos (north); Koyukon, Holikachuk, and Ingalik Athabaskans (central); and Yupik Eskimos (south).

Compiled by Alaska Region.



Along the Norton Sound coast near Egavik, fair weather cumulus clouds over the higher terrain of the Nulato Hills.



Holitna fault scarp, visible at the southeastern front of the Kuskokwim Mountains.

Section M131B—Kuskokwim Mountains

Geomorphology. The Kuskokwim Mountains are northeast-trending ridges having rounded-to-flat summits and broad, gentle slopes. Deep narrow valleys are prevalent. Elevation ranges from 1,310 to 4,430 (400 to 1,350 m).

Lithology and Stratigraphy. The Section consists of deep ocean floor and continental fragments of the Tozitna, Ruby, Innoko, and Nixon Fork terranes. These are tightly folded Paleozoic and earlier rocks, some of which have been metamorphosed.

Soil Taxa. The dominant soils are Aquepts that have pergelic temperature and aquic moisture regimes. Cryaquepts, which are underlain by permafrost, support extensive black spruce forests. The dominant soils of white spruce-birch forests are mainly Cryohumods, Cryorthods, and Cryochrepts.

Potential Natural Vegetation. Open black spruce forests are abundant. Alpine tundra vegetation of sedges and shrubs (willow and alder) cover most hills and ridges. White spruce-paper birch communities occur on hills bordering the Yukon and Kuskokwim Rivers.

Fauna. Horned larks, surfbirds, and white-tailed ptarmigan utilize the habitats in the alpine tundra in this Section. Sharp-shinned hawks and golden eagles are common avian predators in the Kuskokwim Mountains. Northern bog lemmings occur. The Section supports low to moderate populations of brown bears. The deep, oligotrophic lakes provide habitat for trout.

Climate. Average annual precipitation ranges from 12 to 22 in (300 to 560 mm). Average annual temperature ranges from 22 to 29 °F. (-6 to -2 °C). The growing season lasts approximately from May 15 to September 10. The average freeze-free period is 90-110 days.

Surface Water Characteristics. Major streams generally flow northeast to southwest along valleys, corresponding to faults. Streams are swift and meandering. A few oxbow and thaw lakes occur in the valleys, whereas some cirque lakes are located in the glaciated mountains. Permafrost underlies most lowland soils and high mountains, but is absent in soils covered by forests or by grasses and alders. Glaciers are not present. Wetlands occupy up to 53 percent of the area.

Disturbance Regimes. Wildfires are frequent events.

Land Use. Subsistence and recreational hunting and fishing are the main human uses. Mining was formerly important.

Cultural Ecology. Koyukon, Holikachuk, and Ingalik Athabaskans reside in this Section.

Compiled by Alaska Region.

Section M131C–Nushagak-Lime Hills

Geomorphology. This Section comprises largely rounded, flat-topped ridges having broad, gentle slopes and broad, flat, or gently sloping valleys. Elevation ranges from 1,310 to 4,270 ft (400 to 1,300 m).

Lithology and Stratigraphy. The area is composed of continental fragments and near-shore oceanic rocks within the Dillinger and Nixon-Ford terranes. These are generally marine basin deposits of later Mesozoic age and geosynclinal deposits of earlier Paleozoic age. Most of the hills consist of tightly folded graywacke, argillite, conglomerate, and greenstone flows.

Soil Taxa. The dominant soils are Aquepts that have pergelic temperature and aquic moisture regimes.

Potential Natural Vegetation. Spruce-aspen-birch forests prevail at low elevations, whereas alpine tundra heath meadows and barrens dominate at high elevations.

Fauna. White-tailed ptarmigan utilize the habitats in the alpine tundra. Golden eagles are common avian predators in the Lime Hills. Northern bog lemmings occur. The Section supports low to moderate populations of brown bears.

Climate. Average annual precipitation ranges from 22 to 30 in (560 to 760 mm). Average annual temperature ranges from 27 to 32 °F (-3 to 0 °C). The growing season extends approximately from May 15 to September 10. Average freeze-free period is 90 to 110 days.

Surface Water Characteristics. The Section is drained by tributaries of the Kuskokwim River. Rivers that flow from glaciers in the Alaska Range (e.g., Stony and Swift) are braided muddy streams, whereas those that do not (e.g., Holitna) run clear and meander. There are some thaw lakes in valleys. Ponds are abundant in morainal areas. Most of the Section is underlain by permafrost; however, glaciers are not present. Wetlands occupy up to 55 percent of the area.

Disturbance Regimes. Wildfires are frequent.

Land Use. Subsistence and recreational hunting and fishing are the major human uses.

Cultural Ecology. Tanaina Athabaskans are the primary residents.

Compiled by Alaska Region.

Province M135—Alaska Range Humid Tayga - Tundra - Meadow

Two Sections have been delineated in this Province: M135A—Alaska Mountains and M135B—Wrangell Mountains. These Sections are located in southern Alaska, partly bordering Canada. The area of these Sections is about 61,000 mi² (158,000 km²).

Section M135A—Alaska Mountains

Geomorphology. This Section consists of steep, rugged mountain ridges separated by broad valleys. Elevation ranges from 1,640 ft (500 m) in valleys to greater than 13,125 ft (4,000 m) on mountain peaks. Mount McKinley is about 20,320 ft (6,200 m).

Lithology and Stratigraphy. The Section comprises fragments of deep ocean floor rock, as well as continental fragments of Peninsular, Kahiltna, and Wrangellia terranes. These are early Mesozoic to Cenozoic assemblages with very complex morphology.

Soil Taxa. The dominant soils are Aquepts, Orthents, Umbrepts, and Ochrepts, all having pergelic or cryic temperature regimes. About two-thirds of the area has no soil.

Potential Natural Vegetation. A substantial portion of the area is barren of vegetation. Where vegetation exists, alpine and moist tundra communities of prostrate plants predominate. Riparian spruce-hardwood forests occur infrequently at low elevations.

Fauna. Pigmy shrews are present in dry, forested habitats. Pikas are common in the alpine areas. Dall sheep occur throughout the mountainous areas of this Section. Gray wolves are abundant and wolverines are relatively common. This Section has relatively high brown bear densities for interior habitats. The Nelchina caribou herd ranges through this Section. Lake trout are commonly found in the deep, oligotrophic lakes in this Section.



Rugged glaciated mountains of the Alaska Range.

Climate. Average annual precipitation ranges from 10 to 60 in (250 to 1,520 mm). Average annual temperature ranges from 22 to 33 °F (-6 to 1 °C). Freezing conditions may occur year around.

Water Characteristics. Extensive systems of valley glaciers occur at high elevations. Permafrost is discontinuous. Streams are swift and braided, often originate from glaciers, and carry heavy sediment loads. Lakes are more numerous in the southern portion of the area. Soils on lower slopes and in valleys over permafrost are typically poorly drained. Wetlands occupy 7 percent of the area.

Disturbance Regimes. Occurrence of wildfire is low. Snow avalanches are frequent in the winter.

Land Use. Human use of the area is minimal, mainly consisting of hunting and fishing.

Cultural Ecology. Tanaina and Ahtna Athabaskans historically roamed this Section.

Compiled by Alaska Region.

Section M135B-Wrangell Mountains

Geomorphology. This Section, comprised of steep, rugged mountains of volcanic origin, is extensively covered by ice fields and glaciers. Elevation ranges from 1,970 to about 16,400 ft (600 to 5,000 m).

Lithology and Stratigraphy. This Section consists of island-arc volcanoclastic assemblages associated with other Cenozoic rocks. Portions are underlain by Wrangellia terrane.

Soil Taxa. Since much of the area consists of steep rocky slopes, ice fields and glaciers, soils are infrequent and generally thin and stony. Principal soils include Lithic Cryorthents, Typic Cryorthents, Pergelic Cryochrepts, and Pergelic Cryumbrepts.

Potential Natural Vegetation. Most areas are barren of vegetation. Where vegetation occurs, alpine tundra communities of prostrate shrubs, forbs, grasses, and lichens predominate.

Fauna. Trumpeter swans nest in the river valleys, as do widgeons, lesser scaups, and greater scaups. Some of the best habitat for Dall sheep in Alaska occurs in this Section. Gray wolves are also abundant. Grayling occur in clear-water streams.

Climate. Average annual precipitation ranges from 10 to 60 in (250 to 1,525 mm). Average annual temperature ranges from 22 to 30 °F (-6 to -1 °C). Killing frost can occur any time of the year.

Surface Water Characteristics. Ice fields and glaciers are abundant throughout the area. Permafrost is discontinuous. Glacier streams radiate from the area. Lakes are few, and wetlands cover 7 percent of the area.

Disturbance Regimes. Wildfires are almost nonexistent. Snow avalanches are frequent in the winter.

Land Use. Some mining has been conducted in the past. Subsistence and recreational activities presently occur.

Cultural Ecology. Upper Tanana and Ahtna Athabaskans reside here.

Compiled by Alaska Region.

Chapter 13

Province M139–Upper Yukon Tayga - Meadow

One Section has been delineated in this Province: M139A–Upper Yukon Highlands. This Section is located in east-central Alaska, bordering Canada. Its area is about 68,400 mi² (177,200 km²).

Section M139A–Upper Yukon Highlands

Geomorphology. The area mainly consists of rounded, low mountains and hills interspersed frequently by valleys. Elevation ranges from 985 to 5,900 ft (300 to 1,800 m).

Lithology and Stratigraphy. The area consists of fragments of deep ocean floor and continental fragments composed of segments of the Yukon-Tanana, Kandik River, Porcupine, Tozitna, and Ruby terranes. Together these form a very complex geologic matrix.

Soil Taxa. The dominant soils are Ochrepts and Aquepts having a cryic or pergelic temperature regime. Upland soils beneath spruce-birch-aspen forests are commonly Cryochrepts. Black spruce and tundra vegetation, characterized by sedges, usually occurs on Cryaquepts. Cryumbrepts, Cryorthents and Cryorthods also occur, mainly in alpine areas with tundra vegetation.

Potential Natural Vegetation. The vegetation pattern of this area is complex. Forests of white spruce, birch, and aspen dominate most lower slopes in the south and south-facing slopes in the north. Black spruce forests typically grow at higher elevations, on all north-facing slopes in the south, and on all but steep south-facing slopes in the north. Black spruce forests also occur at lower elevations where drainage is impeded. Highest elevations are either barren or have tundra vegetation, with sedge and mosses dominating poorly drained sites and low-growing shrubs on drier sites (e.g., scrub birch and willow).

Fauna. The open, mixed deciduous-conifer forests of the upper Yukon Highlands support a large variety of birds that are characteristic of this Section. Commonly occurring breeding birds include gray jays, boreal chickadees, northern flickers, red-tailed hawks, and boreal owls. Sharp-tailed grouse and upland sandpipers, although considered uncommon, are also characteristic of this area. Hoary marmots occur in the mountainous areas, while woodchucks are found in the lower, open woodlands. This Section provides prime habitat for Arctic ground squirrels and northern flying squirrels. The range of long-tailed and yellow-cheeked voles in interior Alaska corresponds closely with this Section. Upland furbearers, such as marten, mink, and short-tailed and least weasels, are common. Dall sheep are associated with the high, mountainous areas. Caribou from the Delta and Fortymile herds are found here. Bison were introduced into the area in 1928. Wood frogs have been reported in this Section. Northern



Rolling hills east of Eagle.

pike are common in the larger lakes and rivers, while Arctic grayling are more abundant in smaller streams.

Climate. Average annual precipitation ranges from 6 to 14 in (150 to 360 mm). Average annual temperature ranges from 13 to 25 °F (-11 to -4 °C). The growing season lasts approximately from May 15 to September 10. It is probably much shorter at high elevations.

Surface Water Characteristics. Many streams traverse the Section, although extensively rugged areas have little surface water. Some lakes occur in broader valleys. Midsummer soil moisture deficiencies frequently occur on well drained sites. Most valley bottoms, north-facing slopes, and hills greater than 2,625 ft (800 m) are underlain by permafrost. Soils are normally wet or moist under these circumstances. Wetlands occupy about 40 percent of the area.

Disturbance Regimes. Wildfire is a very common disturbance factor due to the relatively warm and dry summer climate and frequent lightning storms.

Land Use. Human disturbance is mainly restricted to subsistence and recreational hunting, although there is occasional mining.

Cultural Ecology. Kutchin, Koyukon, Tanana, Tanacross, Han, and Upper Tanana Athabaskins reside in this Section.

Compiled by Alaska Region.

Province 212—Laurentian Mixed Forest

Thirteen Sections have been delineated in this Province: 212A—Aroostook Hills and Lowlands; 212B—Maine and New Brunswick Foothills and Eastern Lowlands; 212C—Fundy Coastal and Interior; 212D—Central Maine Coastal and Interior; 212E—St. Lawrence and Champlain Valley; 212F—Northern Glaciated Allegheny Plateau; 212G—Northern Unglaciated Allegheny Plateau; 212H—Northern Great Lakes; 212J—Southern Superior Uplands; 212K—Western Superior; 212L—Northern Superior Uplands; 212M—Northern Minnesota and Ontario; and 212N—Northern Minnesota Draft and Lake Plains. These Sections are located in the north-central and northeastern conterminous States, including parts of Minnesota, Wisconsin, Michigan, Pennsylvania, New York, Vermont, and Maine. The area of these Sections is about 147,300 mi² (381,500 km²).

Section 212A—Aroostook Hills and Lowlands

Geomorphology. The Section is part of the New England geomorphic province. It is a glacially scoured

and dissected peneplain characterized by gently rolling terrain and pitted outwash plains, with scattered, low, rounded mountains (monadnocks). Mass wasting and fluvial erosion, transport and deposition are the primary operating geomorphic processes. Elevation ranges from 600 to 1,000 ft (180 to 300 m). Local relief ranges from 300 to 500 ft (90 to 150 m). Gentle slopes cover 50 to 80 percent of the landscape, 50 to 75 percent in the lowlands. Subenvelop elevation range is 325 to 650 ft (100 to 200 m).

Lithography and Stratigraphy. Thin, stony Pleistocene till and stratified drift overlie bedrock, which is composed mostly of non-metamorphosed to weakly metamorphosed interbedded shale, sandstone, limestone, and dolomite (with some minor volcanics) of the Silurian and Devonian systems. Cambrian sandstone and shale occur in a narrow belt in the central part of the Section. Ordovician volcanics occur in the northwestern part of the Section, and scattered Paleozoic intrusives occur toward the south, underlying topographic highs.



Potato fields, Aroostook County, Maine.

Soil Taxa. Dominant soils are Haplorthods, Cryorthods, and Cryaquods with frigid and cryic temperature regimes and mesic and aquic moisture regimes, as well as Haplaquepts of frigid temperature regime and aquic moisture regime.

Potential Natural Vegetation. Küchler vegetation types are northern hardwood and northern hardwood-spruce. Regional characterizations of important vegetation types include lowland red spruce-balsam fir and northern hardwood-conifer. The western boundary of this region coincides with a vegetation transition zone where species characteristic of more temperate regions are replaced by species of more boreal affinity.

Fauna. Spruce grouse, black-backed woodpecker, gray-cheeked thrush, long-tailed shrew, snowshoe hare, and moose characterize colder conifer sites. Ruffed grouse, pileated woodpecker, mourning warbler, Philadelphia vireo, masked shrew, northern bog lemming, northern flying squirrel, and white-tailed deer characterize the hardwood-conifer sites. The Eastern woodland caribou, wolverine, mountain lion, and timber wolf were extirpated through land-clearing activities and European settlement that preceded agricultural development in the mid-nineteenth century. Coyotes, bobcats, black bears (seasonally), and humans are the larger predators today. The spotted salamander, northern two-lined salamander, mink frog, and eastern garter snake characterize a smaller herpetofaunal component compared to warmer and more southerly Sections in Maine. The common loon, osprey, and otter commonly use the larger lakes, rivers, and flowages in this Section. Beech and beaked hazel provide the primary sources of hard mast. No Federally listed threatened and endangered species are unique to this Section.

Climate. Precipitation is evenly distributed throughout the year and averages 35 to 43 in (890 to 1090 mm). Average annual snowfall is from 100 to 120 inches (2540 to 3050 mm). Mean annual temperature ranges from 37 to 43 °F (3 to 6 °C). The growing season lasts for 100 to 120 days.

Surface Water Characteristics. Freshwater resources include lakes, reservoirs, streams, and wetlands. Natural lakes are generally small (less than 10 mi²) and were formed by glacial debris that blocked pre-glacial valleys or as kettle lakes. Drainage is unintegrated (deranged) to dendritic. The St. John River, which forms the northern Maine border, flows across the north and northeast trend of the major bedrock units. Low and moderate gradient

streams are common. Swamps and bogs are common. Wetlands are often from perched water tables. Maximum monthly flows occur in March, April and May; minimum monthly flows occur in September, October and February.

Disturbance Regimes. Disturbance from fire and large scale windthrow is rare. Historical documentation of fire occurrence in this region shows considerable variability through time. Wind disturbance to individual trees and groups of trees may be common. Ice and wet, heavy snow can cause extensive crown damage, particularly in conifer types. Insect and disease disturbances occur, commonly from defoliating insects and particularly from the spruce budworm. Although the distribution of modern and pre-settlement forest types match well regionally, 250 years of land use activity have affected forest structure and composition across the landscape. The land has been both selectively and intensively logged throughout this century and the last. Land has been cleared and farmed since the time of early settlement. Beginning around 1870, land unprofitable for agriculture was abandoned and much was allowed to revert to forest land.

Land Use. About 50 percent of this area is in agricultural use; the remaining land is in forest or is crop land reverting to forest.

Cultural Ecology. Native American hunter-gatherer economies were prevalent within the area as long ago as ten thousand years. Settlements were small and short term. Historically, the area was occupied by Eastern Abnaki Tribal groups. European settlement occurred as early as the 17th century and increased during the following centuries. Nineteenth century timber harvesting resulted in a largely deforested landscape by the 20th century. Harvest of restored second growth timber continues into the latter 20th century. Agriculture, tourism, and winter and summer recreational activities began in the 19th century and continue to thrive today. They are considered the area's leading economic sectors.

Compiled by Northeastern Forest Experiment Station, Northeastern Area State and Private Forestry, and the Eastern Region.

Section 212B—Maine and New Brunswick Foothills and Eastern Lowlands

Geomorphology. The Section is part of the New England geomorphic province. It is a glacially scoured and dissected peneplain dominated by a broad, central, marine plain. The rest of the Section is characterized by gently sloping hills and low, rounded mountains (monadnocks). The Section exhibits some glacial features, primarily kames, eskers, and terraces. Mass wasting and fluvial erosion, transport and deposition are the primary operating geomorphic processes. Elevation ranges from 400 to 1,000 ft (120 to 300 m); local relief ranges from 100 to 500 ft. (30 to 150 m). Gentle slopes cover 50 to 80 percent of the landscape, 50 to 70 percent in the lowlands. Subenvelop elevation ranges from 330 to 980 ft (100 to 300 m).



Middle Orhead Lake, Pond Township, Maine.

Lithography and Stratigraphy. The central lowlands are covered by Pleistocene marine sediments (mostly clay); thin, stony Pleistocene till and stratified drift overlie the rest of the bedrock, which is composed mostly of interbedded shale, sandstone, and limestone of the Ordovician and Silurian systems. Toward the southwestern part of the Section the sedimentary rocks become moderately to strongly metamorphosed. The sedimentary and metamorphic rocks have been intruded by Devonian igneous rocks; large plutons composed of granite, granodiorite, and quartz syenite dominate parts of the Section.

Soil Taxa. Haplorthods with frigid temperature regime and udic moisture regime are the dominant soils in the Section. Eutrochrepts and Haplaquepts with frigid temperature regime and udic and aquic moisture regimes are more common in the eastern half of the Section. Borofibrists are scattered throughout the Section.

Potential Natural Vegetation. Küchler vegetation types are northern hardwood and northern hardwood-spruce. Regional characterizations of important vegetation types include montane red spruce-balsam fir, lowland spruce-fir, northern hardwood-conifer.

Fauna. Spruce grouse, gray jay, boreal chickadee, bay-breasted warbler, Cape May warbler, red bat, snowshoe hare, pine marten, and moose characterize the colder conifer sites in this Section. Ruffed grouse, pileated woodpecker, mourning warbler, Nashville warbler, black-throated warbler, red-eyed vireo, pine grosbeak, smoky shrew, northern flying squirrel, fisher, and white-tailed deer characterize the hardwood-conifer sites. Eastern

woodland caribou, mountain lion, and timber wolf were extirpated through land-clearing activities and European settlement that preceded agricultural development in the early to mid-nineteenth century. Coyotes, bobcats, black bears (seasonally) and humans are the larger predators today. The northern spring salamander, grey tree frog, mink frog, eastern box turtle, northern brown snake, and eastern milk snake characterize a richer herpetofaunal component than more northerly Sections. Common loons, bald eagles, ospreys, and otters commonly use the many large lakes, rivers, and flowages. Beaver commonly alter drainways and wetlands through damming activities. Beech is the primary source of hard mast; oak is a secondary hard mast source. Historically, Atlantic salmon were found in the major rivers (Penobscot and Kennebec) of this Section. Restoration of Atlantic salmon to the Penobscot is underway. No Federally listed threatened and endangered species are unique to this Section.

Climate. A transitional climate exists between that of the coastal zone and that of the more continental climate of regions to the north and west. Precipitation decreases and snowfall increases from east to west. Average annual precipitation 43 to 46 in (1090 to 1170 mm). Snowfall varies from an average of 70 in (1780 mm) in the east to 100 in (2540 mm) in the west. Mean annual temperature ranges from 39 to 45 °F (4 to 7 °C). The growing season lasts from 110 to 140 days.

Surface Water Characteristics. Perennial streams, lakes, and reservoirs provide an abundance of water. Streams along the northern border of this Section pass through a 5 to 10 mi (8 to 16 km) wide belt of steep stream gradients and become low gradient superimposed streams across the northeast trending hills to the south.

Patterns are dendritic and trellis-like. Most lakes are under 10 mi² (26 km²) but nearly a dozen range up to 40 mi² (104 km²). Lakes, bogs, and wetlands are generally remnants of glacial recession twelve to thirteen thousand years ago. Average annual runoff ranges from 18 to 22 in (460 to 560 mm). Extreme peak flows may occur any time of year but are usually associated with hurricanes or rain-on-snow events. Maximum monthly flows occur in March, April, and May, minimum flows occur in fall and late winter.

Disturbance Regimes. Disturbance from fire and large scale windthrow are rare. Historical documentation of fire occurrence in this region shows considerable variability through time. Individual to few tree group level wind caused disturbance may be common. Ice and heavy snow can cause extensive crown damage, particularly in conifer types. Insect and disease disturbance have resulted from defoliating insects, particularly spruce budworm and hemlock looper; impact from beech bark disease and white pine blister rust have been severe. Significant brown ash dieback has also occurred. Although regionally the distribution of modern and pre-settlement forest types match well, 250 years of land use activity have affected forest structure and composition across the landscape. The land has been both selectively and intensively logged throughout this century and the last. Forest land has been cleared and farmed since the time of early settlement. Beginning around 1870, land unprofitable for agriculture was abandoned and much was allowed to revert to forest.

Land Use. Most of the area is in hardwood and conifer forest, most of which is in small holdings. Forest land is used for wood products, hunting, and other types of recreation.

Cultural Ecology. Native American hunter-gatherer economic activities were prevalent within the area as long ago as ten thousand years. Settlements were small and short term. Historically the area was occupied by Eastern Abnaki Tribal groups. European settlement occurred as early as the 17th century and increased during the following centuries. Nineteenth century timber harvesting resulted in a largely deforested landscape by the early 20th century. Harvest of restored second growth timber has continued into the present. Tourism and winter and summer recreational activities, which began in the 19th century, continue to thrive today and together are considered the area's number one economic sector.

Compiled by Northeastern Forest Experiment Station, Northeastern Area State and Private Forestry, and the Eastern Region.

Section 212C—Fundy Coastal and Interior

Geomorphology. The Section is part of the New England geomorphic province. It is a glacially scoured and dissected peneplain with a few low, rounded mountains (monadnocks). The Section exhibits some glacial features, primarily kames, eskers, and terraces. Topography is gently rolling, sloping toward the coastal zone, which is characterized by low ridges surrounded by poorly drained and relatively flat terrain. Coastal and fluvial erosion, transport and deposition are the primary operating geomorphic processes. Elevation ranges from 100 to 400 ft (30 to 120 m), with local relief from 1,000 to 1,400 ft (300 to 425 m). Gentle slopes cover 50 to 80 percent of the area; 50 to 75 percent are found in the lowlands. Subenvelop elevation range is 0 to 160 ft (0 to 50 m).

Lithography and Stratigraphy. The coastal lowlands are covered by Pleistocene marine sediments (mostly clay); thin, stony Pleistocene till and stratified drift overlie the rest of the bedrock. Most bedrock is igneous. Paleozoic granitic and mafic intrusives and Cambrian and Silurian volcanics. Granitic rocks underlie the topographic highs. Mafic intrusives, volcanics, and some fine-grained, lower Paleozoic metasediments underlie lower topography.

Soil Taxa. Haplorthods with frigid temperature regime and udic moisture regime, with smaller representations of Haplaquepts and Dystrochrepts, comprise most of this Section. Borofibrists are also represented.

Potential Natural Vegetation. Küchler vegetation types are northeastern spruce-fir, northern hardwood, and northern hardwood-spruce forests. Regionally described important vegetation types include lowland red spruce-balsam fir, coastal spruce-fir, coastal raised peatlands, and coastal plateau peat lands.

Fauna. Spruce grouse, gray jay, common raven, bay-breasted warbler, Cape May warbler, red bat, snowshoe hare, pine marten, and moose characterize the conifer sites in this Section. Upland sandpiper and savannah sparrow characterize non-forested lands. The American elk and timber wolf were extirpated through land-clearing activities and European settlement in the late 18th century. The walrus was extirpated and sea mink became extinct from coastal sites sometime during the 19th century. Coyotes, bobcats, black bears (seasonally), and humans are the larger predators today. Four-toed salamander, American toad, mink frog, wood turtle, northern water snake, and eastern smooth green snake characterize a richer herpetofaunal component than more northerly Sections. Common loons, bald eagles, osprey, and otters commonly use the many large lakes, rivers, and flowages in this Section. Beaver commonly alter drainways and wetlands through damming activities. Peregrine falcons are returning to historic coastal eyries to nest. Beech is a primary source of hard mast; oak is a secondary hard mast source. The storm petrel, razorbill, roseate tern, laughing gull, Atlantic puffin,



Down East coastal Maine at Mount Desert Isle.

black guillemot, and sharp-tailed sparrow occur in a variety of coastal habitats. Atlantic salmon are found in the Naragansus, Pleasant, and Machias Rivers of this Section. Numerous whales, dolphins, and seals seasonally migrate through the Gulf of Maine, as do several marine turtle species such as the leather back, loggerhead, and Atlantic Ridley turtle. No Federally listed threatened and endangered species are unique to this Section.

Climate. Precipitation ranges from 44 to 50 (1120 to 1270 mm); more precipitation occurs in the winter than in the summer. This part of the Main coast is fog shrouded on average for twice as many hours as more southern coastal regions. Average annual snowfall is 85 in (2160 mm). Mean annual temperature ranges from 39 to 45 °F (4 to 7 °C). The growing season lasts from 100 to 140 days, decreasing from south to north.

Surface Water Characteristics. Perennial streams and wetlands provide an abundance of water. Saltwater resources and tidal influence are important in coastal zones. Drainage includes intermingled trellis and dendritic patterns. Low gradient-incised channels are common. Average annual runoff ranges from 24 to 27 in (610 to 690 mm), increasing toward the coast. Maximum monthly flows occur in March, April, and May. Extreme peak flows may occur any time of year but are usually associated with hurricanes or rain-on-snow events. Minimum monthly flows occur in fall and late winter.

Disturbance Regimes. Disturbance from fire is rare, although historical documentation of fire occurrence in this region shows considerable variability through time.

Severe wind events can cause considerable blowdown in forested communities near coastal areas. Tidal flooding associated with storms occurs along the coast. Insect and disease disturbances have resulted from hemlock looper, spruce budworm, and European larch canker. Severe impacts have resulted from beech bark disease. Although regionally the distribution of modern and pre-settlement forest types match well, 250 years of land use activity have affected forest structure and composition across the landscape. The land has been both selectively and intensively logged throughout this century and the last. Land has been cleared and farmed since the time of early settlement. Beginning around 1870, land unprofitable for agriculture was abandoned and much was allowed to revert to forest land.

Land Use. About 80 percent of this area is in hardwood and conifer forest, most of which is in small holdings. Forest products and recreation are the principal uses of forest land.

Cultural Ecology. As early as ten thousand years ago, Native Americans hunted, fished, and gathered a variety of natural resources in this area. Marine resources were of particular interest. European exploration of the area began as early as 1604. Settlement of small towns and communities followed during the next century. By the latter 19th to early 20th centuries, fishing and other marine-related industries became the major source of economic activity for the area.

Compiled by Northeastern Forest Experiment Station, Northeastern Area State and Private Forestry, and the Eastern Region.



Permaquid Point, Maine.

Section 212D—Central Maine Coastal and Interior

Geomorphology. The Section is part of the New England geomorphic province. It is a glacially scoured and dissected peneplain, sloping toward the coast. It exhibits some glacial features, mainly kames, eskers, and terraces. Flat to gently rolling terrain is characteristic except around Penobscot Bay, where the terrain is dominated by knobby bedrock ridges and high hills that have a linear, southwest to northeast trend. Coastal and fluvial erosion, transport and deposition are the primary operating geomorphic processes. Elevation ranges from sealevel to 400 ft (120 m); Local relief ranges from 100 to 1,000 ft (30 to 305 m). Gentle slopes occupy 50 to 80 percent of the area; 50 to 75 percent are in the lowlands. Subenvelop elevation ranges from 0 to 50 ft (0 to 15 m).

Lithography and Stratigraphy. The coastal lowlands are covered by Pleistocene marine sediments (mostly clay); thin, stony Pleistocene till and stratified drift overlies bedrock along the northern margin. Bedrock geology of this Section is complex; intense faulting and folding created a distinct southwest to northeast structural grain. Bedrock is composed primarily of alternating bands of lower Paleozoic metasedimentary and metavolcanic rocks, quartzite, slate, schist, gneiss, marble, and green stone. Metamorphic grade generally increases from east to west. Scattered granitic plutons occur mostly in the north and east portions of the Section underlying topographic highs.

Soil Taxa. Haplorthods, Haplaquepts, and Eutroquepts with frigid temperature regime and udic and aquic moisture regimes comprise most of the Section.

Potential Natural Vegetation. Küchler vegetation types are northeastern spruce-fir, northern hardwood-spruce, and northern hardwood forests. Regionally this area is described as a transitional zone. From west to east the forest transition ranges from northern Appalachian oak, pine, and mixed hardwoods typical of the southern New England coastal plain to northern coastal spruce-fir and spruce-fir-northern hardwood communities. From south to north, coastal communities grade to more montane spruce-fir and northern hardwood communities. Coastal pitch pine communities are represented on sand dunes and outcrops in the coastal zone.

Fauna. The turkey vulture, tufted titmouse, blue-gray gnatcatcher, brown thrasher, pine warbler, short-tailed shrew, star-nosed mole, small-footed myotis, New England cottontail, snowshoe hare, southern flying squirrel, woodland vole, fisher, white-tailed deer, and moose characterize this transition zone. Upland sandpiper, bobolink, and savannah sparrow characterize non-forest land. The timber rattlesnake, American elk, and timber wolf were extirpated through land clearing activities and European settlement in the late 18th century. Walrus was extirpated and sea mink became extinct from coastal sites some time during the 19th century. Coyotes, bobcats, black bears (seasonally) and

humans are the larger predators today. The redbacked salamander, American toad, grey tree frog, spotted turtle, wood turtle, northern water snake, and ribbon snakes, characterize a richer herpetofaunal component than more northerly and easterly Sections. Common loons, bald eagles, ospreys, and otters commonly use the large lakes, rivers, and flowages in this Section. Beaver commonly alter drainways and wetlands through damming activities. Historically Atlantic salmon were found in the major rivers (Penobscot, Kennebec, and Androscoggin). Restoration of Atlantic salmon to the Penobscot is underway. Oak is a primary source of hard mast; beech is a secondary hard mast source. The storm-petrel, black crowned night-heron, roseate tern, laughing gull, Atlantic puffin, black guillemot, and sharp-tailed sparrow occur in a variety of coastal habitats. Numerous whales, dolphins, and seals seasonally migrate through the Gulf of Maine, as do several marine turtle species such as the leather back, loggerhead, and Atlantic Ridley turtle. No Federally listed threatened and endangered species are unique to this Section.

Climate. Precipitation ranges from 42 to 49 in (1,050 to 1,250 mm); average annual precipitation increases from northwest to southeast. Average annual snowfall ranges from 63 to 80 in (1,600 to 2,000 mm). Mean annual temperature ranges from 39 to 45 °F (4 to 7 °C). The growing season lasts from 140 to 160 days.

Surface Water Characteristics. Many perennial streams, small lakes, and ponds are important sources of water. Drainage is deranged dendritic. Stream gradients are low. Saltwater resources and tidal influence are important in coastal zones. Average annual runoff ranges from 20 to 25 in (510 - 640 mm). Maximum monthly flows occur in March, April, and May. Extreme peak flows may occur any time of year but are usually associated with hurricanes or rain-on-snow events. Minimum monthly flows occur in August, September, and October.

Disturbance Regimes. Disturbance from fire is uncommon, but historical documentation of fire occurrence in this region indicates this has varied. Severe winds can cause considerable blowdown in forested communities near coastal regions. Tidal flooding associated with storms occurs along the coast. Insect and disease disturbances from beech bark disease and white pine blister rust have been severe. Impacts from European larch canker on coastal larch and dwarf mistletoe on coastal white spruce are ongoing. Although regionally the distribution of modern and pre-settlement forest types match well, 250 years of land use activity have affected forest structure and composition across the landscape. The land has been both selectively and intensively logged throughout this century and the last. Land has been cleared and farmed since early settlement. Beginning around 1870, land unprofitable for agriculture was abandoned and much was allowed to revert to forest land.

Land Use. Much of this area is in hardwood and conifer forest, most of which is in small holdings. Agriculture and urbanization are increasingly important land uses near coastal areas.

Cultural Ecology. As early as ten thousand years ago, Native Americans hunted, fished, and gathered a variety of natural resources. Marine resources were of particular interest. European exploration of the area began as early as 1604. Settlement of small towns and communities followed during the next century. By the latter 19th to early 20th centuries, fishing and other marine-related industries became the major source of economic activity for the area.

Compiled by Northeastern Forest Experiment Station, Northeastern Area State and Private Forestry, and the Eastern Region.

Section 212E-St. Lawrence and Champlain Valley

Geomorphology. The Section is part of the St. Lawrence Valley geomorphic province. The eastern half is dominated by Lake Champlain, which is bracketed by wave-cut terraces and low hills. The western prong is characterized by marine plains and rolling, low parallel ridges. Lake shore and fluvial erosion, transport and deposition are the primary operating geomorphic processes. Elevation ranges from 80 to 1,000 ft (25 to 300 m), increasing gradually from the St. Lawrence River southward and from Lake Champlain to the east and west. Local relief ranges from 500 to 1,000 ft. Gentle slopes cover 50 to 80 percent of the area, 50 to 75 percent in the lowlands. Subenvelop elevation range is 0 to 650 ft (0 to 200 m).

Lithography and Stratigraphy. Pleistocene marine clays cover slightly older lacustrine silts and clays that, in turn, cover bedrock. Bedrock is mostly Ordovician carbonate and shale with some Cambrian sandstone. There is a distinctive north-south structural grain around Lake Champlain, associated with early Paleozoic thrust-faulting and sub-parallel graben-faulting. The low ridges at the Section's west end are underlain by tightly folded Proterozoic (Grenville) marble, gneiss, and amphibolite and Cambrian sandstone, displaying a prominent northeast-southwest structural and topographic grain.

Soil Taxa. Hapludalfs, Ochraqualfs, Eutrochrepts, Dystrochrepts, and some Udipsamments with mesic temperature regime and udic moisture regime are common in the Champlain Valley. On the western side of the Adirondacks nearer the St. Lawrence River, soils are primarily Ochraqualfs, Haplaquepts, Humaquepts, Eutrochrepts, and Dystrochrepts, with frigid and mesic temperature regime and udic and aquic moisture regimes.

Potential Natural Vegetation. Küchler vegetation types are northern hardwood and beech-maple forest. Regional characterizations of important vegetation types include transition hardwood-white pine-hemlock, northern hardwood-elm-red maple, northern hardwoods, aspen-gray birch-paper birch, and pitch pine-heath barrens.

Fauna. Prior to European settlement the faunal component of this Section closely resembled those of the neighboring, more mountainous areas (M212C and M212D). Perhaps the greatest difference relates to the relatively flatter topography, which is more attractive to beaver and their associated habitat manipulations. Species associated with wetter habitats (e.g., muskrats, otters, black ducks, cerulean warblers, common yellowthroats, mudpuppies, and map turtles) are more prevalent in this Section than in neighboring Sections. Dating from colonial times, agriculture has continued to influence faunal habitat; 75 percent of the Section remains in agricultural production. This creates a greater abundance of grass, forb, and shrub habitats. Common species include the red-spotted newt, Amercian toad, bullfrog, snapping turtle, garter snake, red-tailed hawk, wild turkey, great horned owl, northern flicker, eastern rufous-sided towhee, song sparrow, red-winged blackbird, eastern cottontail, woodchuck, meadow vole, raccoon, striped skunk, and white-tailed deer. Species which avoid human contact tend to be less prevalent, including the black bear, moose, bobcats, and fisher. No Federally listed threatened and endangered species are unique to this Section.

Climate. Precipitation ranges from 30 to 40 in (760 - 1020 mm). Snowfall averages 40 to 60 in (1020 to 1520 mm) in the Champlain Valley and up to 100 in (2550 mm) over the St. Lawrence Plain near Lake Ontario. Mean annual temperature ranges from 39 to 45 °F (4 to 7 °C). The growing season generally lasts from 120 to 140 days, but increases to about 160 days in a narrow belt around Lake Champlain.

Surface Water Characteristics. The area is bordered by Lake Ontario and the St. Lawrence River and encompasses Lake Champlain, which is roughly 490 mi² (1,270 km²) and 400 ft (122 m) deep. Perennial streams and small lakes contribute to an abundance of water. Wetlands are common. Drainage courses have been superimposed from a previous erosional surface and modified by glaciation. Drainage patterns include rectangular, dendritic, and trellis. Valley streams are low gradient and incised. Moderate gradient streams drain the foothills east of Lake Champlain and west of the Adirondacks. Average annual runoff ranges from 10 to 20 in (250 to 520 mm) increasing with elevation. Maximum monthly flows occur in March and April, minimum monthly flows occur in August, September, and October.

Disturbance Regimes. Fire is an important, small scale disturbance on areas characterized by xeric edaphic extremes. Drought can be an important climatic influence. About 75 percent of this area is in agriculture; the remaining area is in forest. As in other areas dominated

by agriculture in this region, extensive forest land occurs, generally on very dry or wet sites and is second or even third growth. Insect and disease disturbances have resulted from Dutch elm disease, beech bark disease, gypsy moth, false pine budworm, and butternut canker.

Land Use. Most of this area is in farms or forests; only about 6 percent is used for urban development.

Cultural Ecology. Humans have occupied the St. Lawrence River and Champlain Valley for at least ten thousand years, adapting their ways of life in a variety of changing environments. Initially people lived in small, nomadic groups and later in larger settlements. Historically, the area was within the Iroquois Tribal Territory. European exploration of the area began in the 17th century. Fur trade and settlement of the area followed during the 18th century. Industrialization, riverine-related activities, agriculture, concentrated human settlement in metropolitan areas, and recreation are currently the major human activities affecting the ecosystem.

Compiled by Northeastern Forest Experiment Station, Northeastern Area State and Private Forestry, and the Eastern Region.

Section 212F-Northern Glaciated Allegheny Plateau

Geomorphology. The Section is part of the Appalachian Plateaus geomorphic province. It is a maturely dissected plateau of moderate relief, over-printed with notable moraine, drumlin, kettle, scour, and other glacial features. The Section is characterized by irregular topography—broadly rolling with high hills, and steep valleys typified by the north-south trending Finger Lakes. It is demarcated by north-facing escarpments south of and paralleling Lake Ontario, and east-facing escarpments west of and paralleling the Hudson River, the most prominent of which stands up to 2,000 ft (610 m) above the valley. Mass wasting, karst solution, fluvial erosion, and transport and deposition are the primary operating geomorphic processes. Elevation ranges from 650 to 1,970 ft (200 to 600 m); local relief ranges from 400 to 1,000 ft (120 to 300 m). Gentle slopes cover 20 to 50 percent of the landscape; more than 75 percent are in the upland. Subenvelop elevation range is 650 to 1,000 ft (200 to 300 m).

Lithography and Stratigraphy. Most of the Section is covered by thin, stony Pleistocene till and stratified drift. On top of the plateau, beneath the drift, bedrock is mostly Devonian sandstone, siltstone, and shale. Exposed in the escarpments around the plateau's margins are older Devonian limestones and sandstone above Silurian and Ordovician limestone and shale. Silurian conglomerate holds up the most prominent scarp in the southeast corner of the Section. In the central region, bedrock has been broadly folded into a series of gentle, sub-parallel, east-west trending anticlines and synclines.



Allegheny Plateau, Delaware County, New York.

Soil Taxa. Fragiaquepts, Fragiochrepts, and Dytrochrepts with udic and aquic moisture regimes and mesic temperature regime predominate. Frigid temperature regimes are common on topographic highs in the western part of the Section.

Potential Natural Vegetation. Küchler vegetation types include northern hardwoods and Appalachian oak forest. Regionally defined important vegetation types include Appalachian oak-hickory forest, Appalachian oak-pine forest, beech-maple mesic forest, and hemlock-northern hardwood forest.

Fauna. Wildlife species which tend to avoid human contact (e.g., black bear, bobcat, river otter) tend to be fewer in number here than on the unglaciated Allegheny Plateau, where human presence is somewhat less prevalent. White-tailed deer is the most common large mammal. Smaller mammals include beaver, red and gray fox, raccoon, skunk, coyotes, gray squirrel, mink, and muskrat. Wild turkey, ruffed grouse, woodcock, wood duck, and other waterfowl are common game species. Woodland warblers such as the cerulean, mourning, and black-throated green are found throughout the plateau. Raptors include a variety of owls (great horned, barred, saw-whet, screech), buteos (red-tailed, red-shouldered, broad-winged), and accipiters (goshawk, Cooper's hawk, sharp-shinned). Historically this area was habitat for peregrine falcon. Two common cavity nesters are the pileated woodpecker and yellow-bellied sapsucker. Salamanders include the red-backed, spotted,

and northern dusky, as well as red-spotted newts and mudpuppies. Timber rattlesnakes, eastern smooth green snakes, northern leopard frogs, wood turtles, and northern coal skinks also inhabit the plateau. No Federally listed threatened and endangered species are unique to this Section.

Climate. Average annual precipitation is 30 to 50 in (750 to 1250 mm). Average annual snowfall is from 60 to 80 in (1,520 to 2,030 mm). Mean annual temperature ranges from 46 to 50 °F (8 to 10 °C). The growing season lasts for 100 to 160 days.

Surface Water Characteristics. Perennial streams and small lakes provide an abundance of water. This Section is characterized by deeply incised high gradient and bedrock controlled streams in the upland, and low and moderate gradient, mature streams in the valleys. Swamps and marshes occupy poorly drained uplands and valleys. The drainage pattern is dendritic. Numerous waterfalls and rapids exist where streams cross beds of resistant rock. Several prominent streams, including the Mohawk River and tributaries to several of the Finger Lakes, reversed direction of flow during glacial recession. Average annual runoff ranges from 10 to 24 in (250 to 610 mm). Runoff values are lowest in the center of the Allegheny Plateau and increase both east and west. Highest runoff occurs in spring. Lowest runoff occurs in summer and fall.

Disturbance Regimes. Fire was historically of some importance in maintaining oak dominated communities in the central part of the plateau and elsewhere on southern and western slopes of this region. Insect and disease disturbances have resulted from chestnut blight, beech bark disease, sugar maple defoliators, and ongoing ash dieback. Climatic influences include occasional droughts, particularly in the central part of the region.

Land Use. Most of the area is in agricultural land; only about one-third of the land, generally ridge tops and steeper slopes, is forested. Forests are mostly of second and third growth.

Cultural Ecology. Humans first entered the area during the Paleo-Indian period (about 8,000 - 12,000 B.C.) when the climate was much cooler and vegetation was dominated by spruce. The park-tundra environment supported small groups of people who were highly mobile, occupied small hunting and fishing camps, and hunted wild game such as caribou. The Archaic Period (about 8,000 to 1,000 B.C.) was characterized by changes in human adaptations in response to environmental changes. The climate became warmer, the vegetation changed, and new fauna proliferated (e.g., deer, elk, turkey, and passenger pigeon). At the end of the following periods (Transitional to Woodland, about 1,000 B.C. to 1,600 A.D.) Iroquios Tribal horticulturists lived in fortified villages. After the Revolutionary War, Euro-Americans displaced many of the Native Americans and harvested a variety of forest species for increasing timber markets.

Industrialization, along with increased human populations, led to the extinction of some animal species and the extirpation of other species, as well as major modifications in diverse ecosystems.

Compiled by Northeastern Forest Experiment Station, Northeastern Area State and Private Forestry, and the Eastern Region.

Section 212G—Northern Unglaciaded Allegheny Plateau

Geomorphology. This Section is part of the Appalachian Plateaus Geomorphic Province. It is a maturely dissected plateau characterized by sharper ridge tops and narrower valleys than the glaciaded portions of the plateau to the north and west. Drainage is dendritic. Mass wasting, fluvial erosion, transport and deposition are the primary geomorphic processes currently operating. Broad, low amplitude, northeast-southwest trending folds imperceptibly tilt the horizontal sedimentary layers and lend a subtle grain to the topography. Elevation ranges from 1,000 to 2,000 ft (305 to 610 m). Local relief ranges from 100 to 670 ft (30 to 205). Local relief ranges from 100 to 670 ft (30 to 205 m).

Lithology/Stratigraphy. A veneer of unconsolidated materials overlies bedrock. Residium on flat and gently sloping uplands, colluvium on steep hillsides, and alluvium in narrow valley bottoms. Thicker deposits of clay, silt, sand, and gravel are present in wider valleys. Beneath these sediments, the Upper Devonian, Lower Mississippian, and Pennsylvanian bedrock is composed of a mixed siliciclastic sequence of sandstone, siltstone, shale, subordinate conglomerate, occasional limestone, and coal.

Soil Taxa. Alfisols, Entisols, Inceptisols, and Ultisols are the dominant soil orders. Temperature regime ranges from frigid at the summit of the plateau, to mesic in the valleys. Moisture regimes are udic and aquic. Parent materials are residuum from sandstone, siltstone, and shale.

Potential Natural Vegetation. Küchler vegetation types are Northern hardwoods forest and Appalachian oak forest. Eastern hemlock, and American beech-hemlock forests are abundant on moist sites; American beech-sugar maple forests are common on the better drained sites. Common associates include red maple, sweet birch, black cherry, white ash, yellow birch, eastern white pine, yellow-poplar, and cucumbertree.

Fauna. Large herbivores and carnivores on the Allegheny Plateau include the abundant white-tailed deer and the common black bears. Smaller members are bobcats, beaver, red and gray fox, raccoon, skunk, coyotes, gray squirrel, mink, muskrat, and river otters. A variety of birds such as wild turkey, ruffed grouse, woodcock, wood duck, and other waterfowl are hunted. A variety of woodland warblers (cerulean warbler, mourning

warbler, and black-throated green warbler) and woodland raptors (saw-whet owl, goshawk, and red-shouldered hawk) are found on the plateau. Salamanders include the red-backed, spotted, marbled, and northern dusky salamanders. Timber rattlesnakes, northern green frogs, wood turtles, and northern coal skinks also inhabit the plateau. Endangered species include the American bald eagles, northern riffleshell mussel and clubshell mussel.

Climate. Precipitation ranges from 40 to 50 in (1020 to 1270 mm) per year, evenly distributed throughout the year. Snowfall averages from 50 to 100 in (1270 to 2540 mm). Mean annual temperature ranges from 46 to 48 °F (8 to 9 °C). The growing season lasts from 120 to 150 days.

Surface Water Characteristics. This Section has a prominently incised, distinctive dendritic drainage pattern. High frequency of rapidly moving streams and rivers which flow into the Allegheny (flows to Ohio River) and Susquehanna Rivers (flows to Chesapeake Bay). Channels are bedrock controlled. Wetlands are formed in alluvial areas, benches, heads of drainage ways, and in depressions. Seeps and springs are numerous.

Disturbance Regimes. Tornadoes and other windstorms commonly cause catastrophic disturbances on sites tens to thousands of acres in size. Periodic outbreaks of insects (e.g., gypsy moth, elm spanworm, cherry scallop shell moth) and diseases (e.g., chestnut blight, beech bark disease) may cause significant tree defoliation and mortality. Lightning may be an important cause of individual tree mortality. Ice storms have periodically caused large-scale tree crown dieback. Intensive human uses of the land, including logging and oil and gas development, have disturbed this landscape for more than the past one hundred years. Moderate to high deer populations have existed nearly continuously for the past 70 years, causing significant changes in plant composition and structure of the forests.

Land Use. Most of the land is currently in forests, used for recreation, wildlife habitat, hunting, fishing, and production of forest products. Oil and gas production is also a major use.

Cultural Ecology. Humans first entered the area during the Paleo-Indian period (about 8,000 to 12,000 B.C.) when the climate was much cooler and the vegetation was dominated by spruce. The park-tundra environment supported small groups of people who were highly mobile, occupied small hunting and fishing camps, and hunted wild game such as caribou. The Archaic Period, about 8,000 B.C. to 1,000 B.C., was characterized by changes in human adaptations in response to environmental changes. The climate became warmer (much like today), the vegetation changed to an oak-hemlock forest, and new faunae proliferated (e.g., deer, elk, turkey, passenger pigeon). At the end of the following periods (Transitional and Woodland about 1,000 to A.D. 1,600) Native American horticulturists lived in fortified villages. After the Revolutionary War, Euro-Americans displaced many

of the Native Americans and cut the virgin pine stands for downstream timber markets. Industrialization and increased human populations led to the extinction of some animal species (e.g., the passenger pigeon) and the extirpation of other species (e.g., the wolf). Oil emerged as an important industry. The historic logging practices of the wood chemical industry (about 1890 to 1930) created the present Allegheny hardwoods forest, dominated by black cherry.

Compiled by Eastern Region and Northeastern Forest Experiment Station.

Section 212H—Northern Great Lakes

Geomorphology. This Section is part of the Central Lowlands geomorphic province. It is a level to gently rolling lowland (glacial ground moraine) and flat outwash or lacustrine plain, with dune fields near the Great Lakes. Cropping out of the lowlands and plains are partially-buried end moraines and mounded ice-contact hills that trend roughly parallel to the Great Lakes shorelines. Drainage is dendritic with pronounced terracing. Geomorphic processes operating in the Section are fluvial erosion, transport, and deposition; lake-shore erosion and deposition; and minor dune construction. Elevation ranges from 580 to 1,725 ft (176 to 523 m).

In Upper Michigan, the elevation range is mostly between 580 to 850 ft (176 to 259 m). Local relief is generally less than ten feet except in moraines, where it may range up to 325 feet.

Lithology and Stratigraphy. Nearly all of the Section is covered by Pleistocene (Wisconsinan) stratified drift, mostly outwash sand, ranging up to about 1,000 ft (300 m) thick over bedrock. Lacustrine deposits (stratified sand, silt, clay, or marl) occur between morainal and ice-contact ridges, and are widespread in eastern Upper Michigan. Pleistocene and Holocene sand dunes occur near the Great Lakes. Upper Proterozoic, Paleozoic, and Mesozoic sedimentary rocks underlie the drift. Silurian and Devonian limestones and dolomites are locally exposed along Lakes Huron and Michigan; upper Proterozoic and Cambrian sandstones crop out along Lake Superior.

Soil Taxa. Orthods, Boralfs, Udalfs, and Ochrepts with udic moisture regimes occur on moraines and ice-contact features. Psamments with xeric moisture regimes and Aquents with aquic moisture regimes are on outwash and sandy lake plains. Hemists and Saprists with aquic moisture regimes are in very poorly drained areas. Soil temperature regime is frigid.

Potential Natural Vegetation. Küchler vegetation types are northern hardwoods dominating on moraines and stratified ice-contact hills, and northern hardwood-fir forests on similar landforms in the coldest climatic regimes of Upper Michigan. Great Lakes pine forests occurred on outwash and lacustrine sands, with jack pine forests occupying outwash and lacustrine sand plains, and white

and red pine forests on more mesic areas and grading into the ice-contact hills. Conifer bogs occupied low-lying areas in Upper Michigan and near the Straits of Mackinac. The elm-ash forest dominated a part of the Saginaw Bay lowlands in the southeastern part of the Section.

Fauna. Large herbivores and carnivores include whitetail deer and black bears. Gray wolves are present occasionally in Upper Michigan. Other faunae include beaver, otter, raccoon, skunk, coyote, and bobcat. Fisher and pine marten have been reintroduced. Birds include hawks, eagles, peregrine falcons, sandhill and whooping cranes, loons, ducks, quail, grouse, and songbirds. Near the Great Lakes, gulls, terns, sandpipers, and cormorants are found. Anadromous fish such as steelhead, brown trout, and chinook and coho salmon run up rivers and streams from the Great Lakes. Resident fish are brook and rainbow trout; in lakes, there are walleye, northern pike, smallmouth and largemouth bass, and a variety of panfish. Endangered species include the gray wolf, eastern cougar, Kirtland's warbler, piping plover, Karner blue butterfly, American burying beetle, and Hungerford's crawling water beetle.

Climate. Average annual precipitation, which ranges from 27 to 34 in (680 to 1090 mm), is evenly distributed throughout the growing season. Lake-effect snowfall is considerable in some parts, ranging from 70 to 250 in (1800 to 8330 mm) across the Section. Proximity to the Great Lakes results in a cool lacustrine climate, with moderated minimum and maximum temperatures. Average annual temperature ranges from 39 to 43 °F (4 to 6 °C). The growing season lasts for 90 to 155 days, but in some low areas may be as short as 80 days.

Surface Water Characteristics. Low-gradient streams and rivers flow into Lakes Superior, Michigan, and Huron. Streams are underlain by deep sandy outwash deposits, limestone, sandstone, or shale. Numerous lakes and wetlands formed in low-lying areas, often in blocked glacial drainways, or in kettles formed over stranded glacial ice blocks.

Disturbance Regimes. Fire is the dominant natural disturbance in pine forests, with catastrophic fires during pre-European settlement times, occurring in 80 to 250 year intervals. Ground fires occurred more frequently. Gap-phase windthrow is the primary disturbance regime in northern hardwood forests, with about one percent of the canopy affected annually in patches mostly less than a half acre. Larger blowdowns due to windshear and tornadoes occur infrequently, but can cause extensive localized disturbance.

Land Use. European settlement brought clearcutting and widespread slash fires, followed by agricultural use and then extensive land abandonment. Early successional tree species are common, and longer-lived species are seldom older than 80 to 100 years in the second-growth forest. Current land use is for forestry and recreation. Hunting is the most common form of recreation; fishing, boating, snowmobiling, off-road vehicle riding, horseback riding, skiing, hiking, and biking are also popular. There are no

large metropolitan areas in the Section. Forest products industries are common; oil and gas extraction is ongoing and increasing, and a small amount of mining occurs.

Cultural Ecology. Native peoples utilized Great Lakes shorelines and areas near water routes or large water sources for fishing, gathering, and hunting. Limited cultivation and agricultural use occurred during pre-historic and historic times. Inland areas were less utilized because of dense vegetation, wetlands, and insects, although the more accessible outwash areas were periodically burned for blueberry production. During this century, northern lower Michigan has been occupied by farmers, and by descendants of industry workers who moved from southern Michigan. In recent years the area has experienced considerable development from retirees and recreationists, due to its location within a few hours driving time from metropolitan areas. Conflicts develop among residents who typically favor economic development, some for resource development and others for tourism, and recreationists who may favor conservation, or may prefer consumptive recreation. Most of the area is in private ownership. Upper Michigan is relatively sparsely populated, mostly by descendants of European settlers who came to the area for mining or lumbering. It is being impacted by population growth, but less extensively than lower Michigan because of its great distance from cities, and the harsh climate. Most of Upper Michigan is public land.

Compiled by Eastern Region.

Section 212J—Southern Superior Uplands

Geomorphology. This Section comprises the eastern two-thirds of the Superior Upland geomorphic province. About half the Section is level to gently rolling lowlands (glacial ground moraines) and flat laustrine plain; the rest is hillier uplands with escarpments. The lowlands and plains are intermittently overlain by low, undulating ridges (glacial end moraines) and by other mounded or hummocky glacial features (e.g., kames and eskers). Kettled glacial outwash plains are common. Most prominent of the uplands are linear “ranges” trending southwest-northeast along the Superior shore. Drainage is dendritic with only minor entrenchment. Geomorphic processes operating in the Section are lake-shore and fluvial erosion, transport and deposition. Elevation ranges from 600 to 1,980 ft (183 to 603 m). Local relief is generally 100 to 600 ft (30 to 183 m).

Lithology and Stratigraphy. Most of this Section is covered by Pleistocene (Wisconsinan) till and/or stratified drift, up to 500 ft (150 m) thick but much thinner on the uplands. Lacustrine deposits (stratified sand, silt, clay, marl, peat, and muck) occur primarily along Lake Superior. Beneath the drift, bedrock is composed mostly of Proterozoic igneous rocks, both felsic and mafic volcanics and plutonics. Volcanics underlie the most prominent highlands, the “ranges.” Proterozoic metamorphics also occur. quartzite, slate, schist, gneiss,

marble, greenstone, and amphibolite. Proterozoic shale and sandstone crop out along the Superior shore. Archean metavolcanics and granite form bedrock in the northeast corner of the Section. Bedrock outcrops are common in the upland areas.

Soil Taxa. Dominant soils include Spodosols, Entisols, Alfisols, Inceptisols, and Histosols with frigid temperature regime, and xeric, udic, and aquic moisture regimes. Parent materials are dominantly acid, except for calcareous materials associated with the Lake Superior clay plain and the Green Bay lobe.

Potential Natural Vegetation. Küchler vegetation types are maple-beech-birch, aspen-birch, spruce-fir forests. More recent vegetation classification is more specific. Acer-Tsuga Series and Acer-Series occur on mesic landforms; Tsuga Series occur on dry-mesic landforms; Pinus Series occur on xeric landforms; and Tsuga-Thuja Series occur on wetland landforms.

Fauna. Typical species include coniferous and mixed forest warblers. Tennessee, Nashville, northern parula, magnolia, Cape May, yellow-rumped Blackburnian, pine, and black-throated green warblers. Primary predators include Great Plains wolf, lynx, and fisher. Browsers include moose, white-tailed deer, snowshoe hare, and porcupine. Other mammals include arctic shrew, least chipmunk, and northern flying squirrel. Typical herps include red-backed salamander, northern red-bellied snake, wood frog, and wood turtle. Typical fish include brook trout, northern pike, smallmouth bass, white sucker, sculpin, common shiner, and creek chub. Extirpated species reintroduced are the marten, fisher, peregrine falcon, moose, and wolf. The wolverine, mountain lion, woodland caribou, and bison remain expatriates. Unique species to this Section are the Wisconsin River muskellunge and lake trout.

Climate. Average annual precipitation ranges from 26 to 36 in (660 to 910 mm) occurring largely during the summer period. Considerable lake-effect snowfall occurs across this Section, ranging from 60 to 400 in (1,530 to 1,016 mm) from Lake Superior. Temperature ranges from 37 to 43 °F (3 to 6 °C). Most of the Section has a humid-continental climatic regime, with an average annual temperature range from about 39 to 45 °F (4 to 7 °C). Climate along Lake Superior is modified maritime continental, with an average annual temperature range of 37 to 43 °F (3 to 6 °C). The average temperature ranges from 9 °F (January) to 68 °F (July). Most of the Section has 80 to 145 days of average freeze-free period. Along Lake Superior, it is 100 to 140 days.

Surface Water Characteristics. Numerous lakes, streams, springs, spring ponds, and wetlands have formed in the glacial landscape. The drainage network is relatively immature; stream density is relatively low. Within this Section, two major watersheds begin. St. Lawrence (Lake Superior and Lake Michigan) and Mississippi River watershed. Low-gradient streams and rivers characterize most of the Section. High flows

during the spring and fall and low-flow during summer periods characterize most streams and rivers that flow into Lake Superior. Streams are underlain by deep till, outwash, lacustrine, sandstone, and various igneous and metamorphic bedrock types. Lakes are largely associated with collapsed till of moraines and outwash plains.

Disturbance Regimes. Light to medium (10 to 40 percent canopy removal) windfall disturbance dominates in northern hardwoods on mesic landforms. In pine and mixed-pine cover types on xeric and dry mesic landforms, fire is the dominant disturbance, occurring at about 50 to 250 year intervals. Widespread thunderstorm downbursts occur at only about 1,200 to 2,000 year intervals.

Land Use. Extensive clearcutting was followed by catastrophic, hot slash fires in the late 19th and early early 20th centuries. European settlement brought moderate amounts of agricultural clearing (much of which was later abandoned), new species, and suppression of wildfire. Early successional species such as paper birch, big tooth and trembling aspens, and red maple have increased in abundance, while hemlock has been reduced due to a combination of logging, post-logging fire, and deer browsing. The current land cover is dominantly forest vegetation. Dominant land uses are outdoor recreation, wildlife habitat, and production of wood fiber.

Cultural Ecology. Ten thousand years ago small, mobile Paleo-Indian groups hunted large game such as barren ground caribou and gathered a variety of plants typical of the mosaic boreal forest-tundra. During the warm and dry conditions of the Hypsithermal Climatic episode beginning around 8,000 B.C., small game hunting-gathering Archaic populations were drawn to the fisheries, deer, elk and plants of the Lake Superior and Lake

Michigan basins. Increasing moisture associated with the Little Climatic Optimum, 200 B.C., marked significant population increases in the Woodland Native American culture. During 2,000 years of Woodland development, Indian groups focused on a variety of food collection strategies, including horticulture. Europeans ventured into the area by the mid to late 17th century. Mining greatly increased the influx of Europeans during the first half of the 19th century; and following the Civil War, logging became a dominant industry. Euro-American settlement escalated by the beginning of the 20th century, ushering in modern social and economic trends.

Compiled by Eastern Region.

Section 212K—Western Superior

Geomorphology. The Section comprises part of the Superior Uplands geomorphic province. It is mostly poorly drained, flat to slightly rolling ground moraine and plain-pitted outwash with kettles intermittantly overlain by low, undulating ridges (glacial end moraines) and drumlins. Poor to unintegrated (chaotic) drainage dominates, except along the St. Croix River where dendritic drainage is established in and adjacent to a glacial channel. Geomorphic processes operating in the Section are fluvial erosion, transport, and deposition. Elevation ranges from 650 to 1,650 ft (200 to 500 m). Local relief is generally less than 100 ft (30 m), but ranges up to 200 ft (60 m) in pitted outwash areas.

Lithology and Stratigraphy. Most of the Section is covered by either or both Pleistocene (Wisconsinan) till and stratified drift, ranging in thickness from 100 to 600 ft (30-180 m). Beneath the drift, bedrock is



Western Superior Section landscape.

composed mostly of Proterozoic igneous rocks—volcanics and plutonics, both felsic and mafic. Proterozoic and lower Cambrian quartzite, slate, and marble, and Archean metavolcanics and quartzite occur in scattered areas.

Soil Taxa. Boralfs, Orthrepts, and Orthods, with a scattering of Histosols, occur. Moisture regime is mostly udic with some xeric in Orthods, and aquic in Histosols and some of the Ochrepts. Temperature regime is frigid. Soils are generally coarsely textured (sandy) and well to excessively drained in the eastern part, and medium textured, moderately to somewhat poorly drained in the western part.

Potential Natural Vegetation. Primarily coniferous and deciduous forests dominate. Some jack pine and oak barrens are on the Bayfield peninsula. Küchler types are mapped as Great Lakes pine forest, Great Lakes spruce-fir forest, and maple-basswood forest.

Fauna. The pine barrens (pine savannas) of this area historically and presently contain a characteristic assemblage of breeding birds, including many grassland birds that are now uncommon elsewhere, such as uplands sandpiper, sharp-tailed grouse, clay-colored sparrow, and vesper sparrow. The Great Plains wolf is becoming quite successful in re-colonizing this Section. The Karner blue butterfly (Federally threatened) is found associated with lupine in the pine barrens throughout much of this Section. Several other rare butterflies are found, including regal fritillary, Laurentian skipper, and hoary elfin. Singing male Kirtland's warblers have been found, making this perhaps the only Section capable of supporting a population of Kirtland's warblers besides 212H. herptiles typify this Section reaching high densities and providing a critical food source for raptors such as merlins. Characteristic herps include the northern prairie skink and smooth green snake. Moose were once abundant in this Section and are slowly recovering today. Eastern pocket gophers, badgers, and coyotes are characteristic mammals.

Climate. Precipitation ranges from 26 to 32 in (650 to 810 mm). About two thirds of this amount occurs during the growing season. Average annual snowfall is 50 to 70 in. Mean annual temperature ranges from 39 to 45 °F (4 to 7 °C). The growing season lasts for 120 to 140 days.

Surface Water Characteristics. There exists a relatively low frequency of low-gradient streams. Small natural lakes are fairly common, except on the Bayfield Peninsula.

Disturbance Regimes. Fires were very intensive, frequent, and quite severe on the landscape. This helped to keep a conifer dominated uplands Forest. The Jack pine and oak barrens were also maintained by intensive fires. Logging, grazing, and farming also caused large dramatic disturbances.

Land Use. Current dominant land uses are commercial forestry, dispersed outdoor recreation, and agriculture.

Cultural Ecology. Humans have occupied the Upper Mississippi Valley cultural area for at least 10,000 years, adapting their ways of life in a variety of changing environments. Conditions have varied: from cool, wet tundra supporting herds of open land-grazing animals such as bison and caribou; through a warm, dry, savanna period when availability of water and aquatic resources was drastically altered; to the forests and tall grass prairie of the present. People initially lived in small, nomadic groups and later in larger villages, changing their hunting, fishing, and gathering methods as environmental conditions changed, to enable the most efficient resource use. Horticulture has been practiced for about 1,000 years. Within the last 300 years, the near extinction of some species of fur-bearing mammals for the fur trade, the harvesting of forests by logging, and cultivation and dairy farming have significantly altered the environment. Today, farming, industrialization, and recreation are the major human activities affecting the ecosystem.

Compiled By. Eastern Region and Minnesota Department of Natural Resources.

Section 212L—Northern Superior Uplands

Geomorphology. The Section is part of the Superior Uplands geomorphic province. It is a glacially scoured peneplain characterized by level-to-rolling uplands and hills. Most prominent of the hills are linear ranges trending southwest to northeast along Lake Superior and parallel ranges farther north (Mesabi, Vermillion). There is a prominent escarpment along Superior's shore. Innumerable small lakes and potholes dominate the northern part of the Section. An east to west trending series of small lakes occurs in the northeasternmost portion of the Section; and an east to west trending series of larger lakes follows a fault zone in the most western part of the Section. Elevation ranges from 600 to 2,280 ft (183 to 695 m). Local relief ranges from 600 (180 m). General relief is 10 to 60 ft (3 to 20 m). Upland areas rise 300 to 600 ft (90 to 180 m) above lowlands, interspersed between lakes or bogs.

Lithology and Stratigraphy. Most of the Section is covered by either or both thin Pleistocene (Wisconsinan) till and stratified drift, more than 20 ft thick (6 m) in some areas, but much thinner on the uplands. Beneath the drift in the western half of the Section, bedrock is composed of Archean quartzite, banded iron oxides, metagabbro, greenstone, and granite. Granite underlies some of the ranges. Proterozoic mafic volcanics and intrusives dominate bedrock in the hills along Superior's shore and in the northeast. The linear grain along the northeastern border is created by structure in Proterozoic slate and marble, forming bedrock. Outcrops are common in the uplands areas.

Soil Taxa. Inceptisols, Entisols, Alfisols, and Histosols occur in a frigid temperature regime with mostly udic and aquic moisture regimes. Relatively shallow to bedrock



Typical landscape in Superior National Forest, northeastern Minnesota.

soils (Lithic Dystrichrepts and Lithic Udorthents) are significant components. Parent materials are dominantly noncalcareous.

Potential Natural Vegetation. Dominant vegetation includes mixed pine with aspen-birch, white pine, red pine, jack pine, black spruce, balsam fir, and white cedar, with less common occurrences of northern hardwoods along the shore of Lake Superior. Küchler types are Great Lakes spruce-fir forest and Great Lakes pine forest.

Fauna. Except for the extirpation of the woodland caribou, this area has had no substantial faunal changes in historic time. Populations and focus locations have varied, but the resident species have remained intact. Two species that characterize the area are the common loons and the gray wolf. Although the wolf is currently listed as an endangered species, it is increasing in population due to restrictions on hunting and trapping. Black bear are common, with fishers, martens, coyotes, bobcats and lynxes also being present. Caribou and wolverines are sighted along the Canadian border. Cool or cold water lakes support lake trout, walleye, northern pike, and the whitefishes. Walleye and northern pike are also typical of large rivers. Cold water streams support brook trout, white suckers, and sculpins. Warm water streams support a variety of minnow species and smallmouth bass.

Climate. Precipitation averages 26 to 31 in (660 to 780 mm), with 60 percent falling in the growing season. Precipitation in winter occurs as snow; annual snowfall is 65 in (1650 mm). Mean annual temperature ranges from 36 to 38 °F (2 to 3 °C). The growing season lasts for 80 to 123 days. The longer end of the spectrum occurs

adjacent to the Lake Superior shore, while the shortest growing season is in lower areas relatively far inland from Lake Superior.

Surface Water Characteristics. There is a high frequency of lakes, streams, and wetlands. Many are bedrock controlled. The two major drainage basins are Hudson Bay and Lake Superior, separated by the Laurentian Divide. Streams flow south to east from the divide directly to Lake Superior, or southwest from the divide through the St. Louis River into Lake Superior. Streams flow predominantly north and west from the divide to Rainy and Little Fork Rivers and then to Hudson Bay. The vast majority of lakes in both major basins have inlets and outlets and are part of the stream systems. The frequency of lakes increases to the northeast in the Lake Superior Basin. Lakes occur frequently and are fairly evenly distributed throughout the Hudson Bay Basin. Wetlands are a common feature throughout both major basins.

Disturbance Regimes. Fire, windstorm, insect infestation, animal browsing, and logging are major disturbances. Fires have burned 80 to 90 percent of the area one to several times during the last three hundred to four hundred years. High intensity crown fires tend to occur once every one hundred fifty to two hundred years. Low intensity fires tend to occur about every twenty to forty years. Atmospheric pollutants of greatest concern are mercury, ozone, and acidifying substances. Of these, only mercury has resulted in a demonstrated effect on resource uses through health-based limits on fish consumption by humans. Ozone impacts on vegetation and mercury impacts on wildlife (other than fish) are suspected, but have not been adequately studied to assess severity.

Cultural Ecology. About 12,000 years ago, the first Paleo-Indians inhabited a tundra-scrub boreal forest environment, living in small extended family units of ten to fifteen persons. They were highly mobile and sparsely distributed over the landscape, subsisting on hunting the barren ground caribou. The Shield Archaic culture replaced the Paleo-Indian culture around 8,500 years ago. While the Archaic people probably continued to gather plants and hunt Woodland caribou and moose, they were also building dug-out canoes of pine, as fishing became the major subsistence activity. As the present climate developed, the Woodland culture replaced the Archaic. Wild rice became abundant in the ricing lakes and rivers, either naturally or through "nurturing" by the Woodland people. Woodland people were harvesting rice by seventeen hundred years ago. By fifteen hundred years ago, they were using the bow and arrow. During the late 17th century, native people participated in fur trade, first with the French, then the British, and the Americans until the mid-1800's. While the beaver was sought initially, trade was extended to most fur-bearing animals, which resulted in population declines. The later part of the 1800's brought logging to the area. Small fishing communities were established at the mouth of many rivers on the north shore. Inland mineral exploration also occurred during this time. Minor agriculture and settlement patterns associated with timber harvesting developed. Exotic species have been introduced to this area through Great Lakes shipping and through recreational hunting, fishing, and canoeing. Iron ore mining has had a large influence, as one of the world's largest open pit iron mines is located in the northwest part of the Section. However, due to the rugged terrain and cost of constructing transportation corridors, the area has remained relatively undeveloped. Consequently, most of the area has maintained its "wild" recreation perception and is valued aesthetically.

Land Use. Current major land uses are outdoor recreation, forestry, and mining.

Compiled by Eastern Region.

Section 212M-Northern Minnesota and Ontario

Geomorphology. The Section is part of the Central Lowlands geomorphic province. It is dominated by a flat glacial lake plain. Some low moraines and beach ridges occur, especially in the northwest and east. The Section is poorly drained, with mostly boggy ground. Anoxic accumulation of plant material is the dominant geomorphic process operating; fluvial erosion, transport and deposition occur in the northwest. Elevation ranges from 1,100 to 1,500 ft (330 to 450 m). Local relief is less than 50 ft (15 m).

Lithology and Stratigraphy. Quaternary peat deposits cover the central two-thirds of the Section. Pleistocene till and lacustrine sand cover bedrock in the northwest and probably underlie most of the peat bog; lacustrine sand and silt rim the eastern and southern margins. Bedrock is

composed of Archean granite, gabbro, and greenstone in the western half, with Archean quartzite and banded iron oxides underlying the eastern portion of the Section.

Soil Taxa. Dominant soil orders are Histosols and Alfisols with frigid temperature regime and aquic moisture regime. Soils are dominantly cold and wet. Organic soils (mainly peat) prevail in the western two-thirds of the Section.

Potential Natural Vegetation. K  chler types are (primarily) conifer bog, with lesser extent of Great Lakes spruce-fir and Great Lakes pine. Sedge fen, black spruce-sphagnum bog, and white cedar-black ash swamp dominates the Section. Some low moraines and beach ridges are dominated by jack pine or trembling aspen-paper birch forests.

Fauna. A variety of vertebrate species richness tends to be poor, due to the rather monotonous habitats associated with the "big bog" country. Some ecosystems in this Section support unique faunal communities, including rare species such as northern bog lemming. Typical wildlife of this areas includes moose, sharp-tailed grouse, and songbirds associated with lowland conifer and sedge fen communities. Portions of this Section that are adequately drained and have associated upland forest types support a fauna similar to that of Section 212N. Portions of this area are important migrant stop-overs for a variety of geese and other waterfowl and sandhill cranes. Important sport fisheries are associated with Red Lakes and lakes near the international boundary.

Climate. Precipitation averages 21 to 25 in (530 to 630 mm). About 40 to 50 percent occurs during the growing season. Annual snowfall is from about 40 to 49 in (1000 to 1240 mm). Mean annual temperature ranges from 37 to 41   F (3 to 5   C). The growing season lasts for 98 to 111 days.

Surface Water Characteristics. Streams tend to be low density, small, and sluggish. A few large lakes, remnants of glacial Lake Agassiz, are present. They include Upper and Lower Red Lakes and Lake of the Woods. Drainage is to the north, into the Hudson Bay system.

Disturbance Regime. Fire occurred on the peat lands. Insect infestations, such as spruce budworm probably lead to fires. Water level fluctuation, caused both by short-term climatic changes and by beaver dams, probably contributed to tree mortality.

Land Use. The current dominant land uses are forestry and outdoor recreation, including hunting and fishing.

Cultural Ecology. Humans have occupied the area for at least 10,000 years, adapting their ways of life in a variety of changing environments. Conditions have ranged: from cool, wet tundra supporting herds of open land grazing animals such as bison and caribou; through

a warm, dry, savanna period when availability of water and aquatic resources was drastically altered; to the mixed deciduous-coniferous forests of the present. People lived in small, nomadic groups and larger villages, altering their hunting, fishing, and gathering methods as environmental conditions changed, enabling the most efficient resource use. Within the last 300 years, the near extinction of some species of fur-bearing mammals for the fur trade, the cutting of the pine forests by logging, and cultivation of the land have significantly altered the environment. Farming, logging, and recreation are the major human activities currently affecting the ecosystem.

Compiled by Eastern Region and Minnesota Department of Natural Resources.

Section 212N—Northern Minnesota Drift and Lake Plains

Geomorphology. This Section is part of the Central Lowlands geomorphic province. It is a level to gently rolling lowland characterized by its glacial features, outwash plains, kettles, bogs, lake plains, till plains, narrow outwash channels, morainal ridges, and drumlin fields. Drainage is poorly to moderately integrated and includes the headwaters of the Mississippi River. Fluvial erosion, transport and deposition are the primary operating geomorphic processes. Elevation ranges from 1,100 to 1,850 ft (330 to 560 m). Local relief ranges from 50 to 165 ft (15 to 50 m).

Lithology and Stratigraphy. Pleistocene till and stratified drift cover bedrock to a depth of 200 to more than 600 ft (60 to 180 m). Beneath the drift, bedrock is a mixture of Archean granite, greenstone, and metasediments, including banded iron oxides. Small, isolated outliers of Cretaceous shale and sandstone overlie the Archean in the southwest.

Soil Taxa. Alfisols, Entisols, Inceptisols, and Histosols dominate. Temperature regime is frigid. Moisture regimes are udic, xeric, and aquic. Uplands are dominantly medium-textured to coarse-textured, and moderately well to somewhat excessively drained. Lowlands are extensive, poorly drained, and include a significant component of organic soils.

Potential Natural Vegetation. Vegetation includes a mix of conifer and hardwood forest communities. Northern hardwoods grow in the south and around larger lakes. Conifers (Great Lakes pine and Great Lakes spruce-fir) are associated with outwash plains and coarsely textured end moraines. Large areas of lowlands are dominated by potential natural communities of black spruce, tamarack, and sedge meadows. Kùchler types are Great Lakes pine forest, Great Lakes spruce-fir forest, and conifer bog.

Fauna. Richness of vertebrate species richness is very high in response to the interspersed and juxtaposition of upland, wetland, and aquatic ecosystems. Upland habitats support a great variety of songbirds, including neotropical migrants such as ovenbirds, American redstarts, and pine warblers. Riparian zones support high populations of threatened bald eagles, ospreys, mink, and otters. Herpetofauna are abundant in the lakes and wetlands, but few species are represented due to climatic limitations. Larger mammals include the threatened gray wolf and its major food sources, white-tailed deer and an occasional moose; black bears are common to abundant. Waterfowl, common loons, and other water birds are abundant in shallow lakes and wetlands, contributing to the uniqueness of this Section. Fish resources are rich; game species are dominated by walleye, northern pike, and a variety of panfish. Trout resources are limited primarily to lakes, with only a few marginal trout streams.

Climate. Precipitation averages 23 to 27 in (580 to 690 mm). About 40 percent occurs during the growing season. Snowfall ranges from 39 to 49 in (990 to 1,240 mm). Temperature averages 37 to 43 °F (3 to 5 °C). The growing season lasts for 111 to 131 days.

Surface Water Characteristics. This Section includes the headwaters of the Mississippi River. Lakes are numerous and are associated with moraines and pitted outwash plains. The drainage network is poorly developed. Low gradient streams are common.

Disturbance Regimes. Fire occurred historically on about a 10 to 40 year rotation within much of the Section, accounting for a dominance of upland conifers and trembling aspen-birch forests.

Land Use. Current dominant land uses are forest management and dispersed outdoor recreation. Agriculture is important in localized areas.

Cultural Ecology. Humans have occupied the area for at least 10,000 years, adapting their ways of life in a variety of changing environments. Conditions have ranged: from cool, wet tundra supporting herds of open land grazing animals such as bison and caribou; through a warm, dry, savanna period when availability of water and aquatic resources was drastically altered; to the mixed deciduous-coniferous forests of the present. People lived in small, nomadic groups and larger villages, altering their hunting, fishing, and gathering methods as environmental conditions changed, enabling the most efficient resource use. Within the last 300 years, the near extinction of some species of fur-bearing mammals for the fur trade, the cutting of the pine forests by logging, and cultivation of the land have significantly altered the environment. Farming, logging, and recreation are the major human activities currently affecting the ecosystem.

Compiled by Eastern Region and Minnesota Department of Natural Resources.

Province M212–Adirondack-New England Mixed Forest - Coniferous Forest - Alpine Meadow

Five Sections have been delineated in this Province: M212A–White Mountains; M212B–New England Piedmont; M212C–Green, Taconic, Berkshire Mountains; M212D–Adirondack Highlands; and M212E–Catskill Mountains. These Sections are located in the northeastern conterminous States, including parts of New York, Vermont, New Hampshire, Massachusetts, and Maine. The area of these Sections is about 43,600 mi² (112,900 km²).

Section M212A–White Mountains

Geomorphology. The Section is part of the New England geomorphic Province. It is a glacially scoured, maturely dissected, irregular highland characterized

by clusters of low, rounded mountains and scattered monadnocks. Highest elevations occur in a wide belt trending southwest to northeast through the Section, ending in central Maine. Glacial features are most evident in the Section's southern half and include cirques carved into the high peaks and U-shaped valleys, as well as kames, eskers, and drumlins. Mass wasting, fluvial erosion, transport and deposition are the primary geomorphic processes. General elevation ranges from 1,000 to 4,000 ft (300 to 1,200 m); isolated peaks are greater than 5,000 ft (1,500 m); local relief ranges from 1,000 to 3,000 ft (300 to 900 m). Gentle slopes cover 20 to 50 percent of the area; 75 percent of gentle slopes occur in the lowland. Subenvelop elevation ranges from 200 to 1,800 (60 to 550 m).



Mount Washington, New Hampshire.

Lithology and Stratigraphy. Thin, stony Pleistocene till and stratified drift mantle the bedrock except in the Connecticut River valley, where lacustrine sediments and terraces are thick. In the northern half of the Section, bedrock is mostly Devonian and Silurian sedimentary rocks which become metamorphosed to quartzite, slate, and schist toward the southwest. The mountainous belt is underlain by Paleozoic igneous rocks (granite, diorite, gabbro, rhyolite, and basalt) that either intrude or both intrude and cover lower Paleozoic schists, and by Proterozoic and Cambrian gneiss. Much younger Mesozoic granites occur at the southern end, intruding the most abundant rock types there, gneiss and amphibolite.

Soil Taxa. Haplorthods, Haplaquepts, and Dystrochrepts with frigid temperature regime and udic and aquic moisture regimes comprise most of the soils. Cryorthods and Cryaquods with cryic temperature regime and udic and aquic moisture regimes are common at the highest elevations.

Potential Natural Vegetation. Küchler vegetation types include northern hardwood, northern hardwood-spruce, and northeastern spruce-fir forest. Regionally-defined important vegetation types include northern hardwood-conifer, montane spruce-fir, lowland spruce-fir, alpine krummholz, and alpine meadow. Robbin's cinquefoil is a Federally listed plant, unique to alpine communities of the Presidential Range in New Hampshire.

Fauna. Spruce grouse, black-backed woodpecker, gray-cheeked thrush, long-tailed shrew, red squirrel, snowshoe hare, and moose characterize the colder conifer sites. Ruffed grouse, pileated woodpecker, broad-winged hawk, mourning warbler, chestnut-sided warbler, red-eyed vireo, barred owl, rose-breasted grosbeak, masked shrew, northern bog lemming, northern flying squirrel, and white-tailed deer characterize the hardwood-conifer sites. Eastern woodland caribou, wolverine, mountain lion, and timber wolf were extirpated. A few lynxes, bobcats, coyotes, black bears (seasonally), and humans are the larger predators today. Pine martens are increasing and fishers are common. Spotted salamander, redback salamander, wood frog, northern leopard frog, mink frog, and eastern garter snake characterize a smaller herpetofaunal component compared to warmer and more southerly Sections in Maine and New Hampshire. The common loon, osprey, and otter commonly use the larger lakes, rivers, and flowages in the Section. Beech provides the primary source of hard mast in the Section.

Climate. Mean annual precipitation is 36 to 70 in (910 to 1,780 mm); total annual snowfall ranges from 96 to 160 in (2,440 to 4,060 mm). Rain and snowfall increase locally with elevation. Mean annual temperature ranges from 37 to 45 °F (3 to 7 °C). The growing season lasts for 80 to 130 days.

Surface Water Characteristics. Perennial streams provide an abundance of water. The area contains the major drainage divide in New England. The Section includes the headwaters of numerous streams including

the St. John, Penobscot, Kennebec, Androscoggin, Connecticut, and Merrimack Rivers. Drainage networks have deranged, rectangular, and dendritic patterns which developed as stream courses imposed from the Cenozoic were modified during the Pleistocene. For example, the Connecticut River flows across the trend of bedrock units, while the Androscoggin River skirts a major granitic pluton which the Presumpscot River drains. Stream gradients in the St. John River network are generally low; stream gradients for the other rivers are moderate to steep. Average annual runoff ranges from 16 to 24 in (410 to 610 mm) generally and from 16 to 50 in (410 to 1,270 mm) in the more rugged terrain of Maine and New Hampshire. Runoff increases locally with elevation. Maximum monthly streamflows occur in March and April. Extreme peak flows can occur any time of year and are usually associated with hurricanes or rain-on-snow events. Minimum monthly flows occur in August, September, and October. The Section contains numerous lakes, a number of which are between 10 to 45 mi² (26 to 117 km²) in size. The largest is Moosehead Lake which is roughly 120 mi² (310 km²).

Disturbance Regimes. Montane forests in this region lack significant fire regimes and are characterized by large blowdown disturbances resulting from hurricanes or other severe wind events and smaller area, single tree phenomena. Higher elevation forests are often characterized by an even-aged windthrow disturbance phenomenon known as fir-waves. Insect and disease disturbances have resulted from gypsy moth, spruce budworm, spruce beetle, severe beech bark disease, and butternut canker. At higher elevations, spruce decline is related to severe winter injury and soil cation depletion. Forest composition at lower elevations has been influenced by agriculture dating from the colonial period and subsequent farm abandonment since about 1870, as well as by selective logging of certain species, particularly conifers. Although regionally the distribution of modern and pre-settlement forest types matches well, 250 years of land use activity has affected forest structure and composition across the landscape. The land has been both selectively and intensively logged throughout this century and the last. Forest land has been cleared of trees and farmed since the time of early settlement. Beginning around 1870, land unprofitable for agriculture was abandoned and often allowed to revert to forest land.

Land Use. More than 90 percent of this area is forested. Most of the remaining area consists of isolated farms and small residential developments. The dominant land use is recreation. Production of wood for lumber and pulp is also important.

Cultural Ecology. Native American hunter-gatherer economic activities were prevalent within the area as long ago as 10,000 years. Settlements were small and short term. Historically, the area was occupied by Eastern Abnaki Tribal groups. European settlement occurred as early as the 17th century and increased during the following centuries. Nineteenth century timber harvesting resulted in a largely deforested landscape by

the early 20th century. Harvest of restored second growth timber continues into the present. Tourism and winter and summer recreational activities, began in the 19th century and continue to thrive today. Combined, they are considered the area's number one economic sector.

Compiled by Northeastern Forest Experiment Station, Northeastern Area State and Private Forestry, and the Eastern Region.

Section M212B–New England Piedmont

Geomorphology. The Section is part of the New England geomorphic Province. It is a glacially scoured, maturely dissected peneplain with open, low mountains and mounds. Glacial features include kames, eskers, drumlins, and lacustrine plains. Mass wasting, fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation ranges from 600 to 3,000 ft (180 to 900 m); local relief ranges from 1,000 to 3,000 ft (300 to 900 m). Gently sloping land covers 20 to 50 percent of the area; more than 50 percent is found in lowlands. Subenvelop elevation ranges from 200 to 1,800 (60 to 550 m).

Lithology and Stratigraphy. Thin, stony Pleistocene till and stratified drift mantle the bedrock, except in the Connecticut River valley where lacustrine sediments and terraces are thick. In the northern half of the Section, bedrock is mostly Devonian and Silurian quartzite, slate, and schist, with small granitic intrusions. Toward the southern end, lower Paleozoic granite and higher-grade metamorphics (mostly gneiss) dominate, with a north to south belt of volcanics.

Soil Taxa. Haplorthods, Haplaquods, and Haplaquepts with frigid temperature regime and udic and aquic moisture regimes are common. Fragiocchrepts and Dystricchrepts with mesic temperature regime and udic moisture regime are common in the northern Connecticut River valley.



Central New Hampshire.

Potential Natural Vegetation. Kuchler vegetation types include northern hardwood and northern hardwood-spruce forest. Regionally-defined important vegetation types include montane spruce-fir, lowland spruce-fir, northern hardwood-conifer, and transition hardwood-conifer.

Fauna. Gray jay, Cape May warbler, dark-eyed junco, red bat, snowshoe hare, red squirrel, fisher, and moose characterize the colder conifer sites in this Section. Ruffed grouse, pileated woodpecker, turkey, red-tailed hawk, chestnut-sided warbler, Nashville warbler, black-throated blue warbler, red-eyed vireo, rufous-sided towhee, scarlet tanager, smoky shrew, northern and southern flying squirrel, and white-tailed deer characterize the hardwood-conifer sites. Timber rattlesnake (in the southern part), American elk, timber wolf, and mountain lion were extirpated through land clearing and settlement activities. Coyotes, bobcats, a few lynxes, black bears (seasonally), and humans are the larger predators today. Pine martens and fishers are locally common. Beaver-created wetlands in this Section are common. Bullfrog, green frog, black duck, wood duck, hood merganser, northern harrier, great horned owl, meadow vole, mink and otter characterize the variety of wetlands. Spotted salamander, redback salamander, American toad, grey treefrog, spotted turtle, wood turtle, northern water snake, and ribbon snakes characterize a richer herpetofaunal component than more northerly Sections. Oak and beech are primary sources of hard mast. No Federally threatened or endangered species are unique to this Section.

Climate. Mean annual precipitation ranges from 35 to 48 in (900 to 1,220 mm); mean annual snowfall ranges from 64 to 96 in (1,620 to 2,440 mm). Mean annual temperature averages 40 to 45 °F (4 to 7°C). The growing season lasts for 110 to 160 days.

Surface Water Characteristics. Perennial streams are important water sources. Small lakes and wetlands occur in headwater and valley positions. The Connecticut River and its tributaries dominate the unit. The area contributes to the Hudson, St. Lawrence, and Merrimack River systems. Trellis and dendritic drainage patterns occur. Metasedimentary bedrock is exposed in some streambeds, while Proterozoic rock and alkalic plutonic rock are more likely to be found in boulder beds. Stream gradients range from low to moderate and steep. Streams are generally incised. Average annual runoff ranges from 16 to 28 in (410 to 710 mm). High values reflect differences in local topography. Maximum monthly streamflows occur in March and April. Extreme peak flows can occur any time of year and are usually associated with hurricanes or rain-on-snow events. Minimum monthly flows occur in August, September, and October.

Disturbance Regimes. This area occupies the lower end of a regional disturbance gradient, ranging from relatively frequent occurrence of fire and hurricane winds in southern New England and New England coastal areas to a very low incidence of disturbance in more

northern inland sites. Percent of land in forest continues to increase over time. However, composition of present day forest on a landscape scale is heavily influenced by agriculture dating from the colonial period and subsequent farm abandonment from about 1870, as well as by selective logging of certain species, particularly conifers. Although regionally the distribution of modern and pre-settlement forest types match well, 250 years of land use activity have affected forest structure and composition across the landscape. Insect and disease disturbances have resulted from chestnut blight, gypsy moth, spruce budworm, severe beech bark disease, butternut canker, and periodic birch and sugar maple defoliators. At higher elevations, spruce decline is related to severe winter damage and soil cation depletion.

Land Use. Eighty percent of this area is in hardwood and conifer forest, most of which are in small holdings. The remaining area is in residential development, agricultural use, or urban land. Recreation is a dominant land use.

Cultural Ecology. Native American hunter-gatherer economic activities were prevalent within the area as long ago as 10,000 years. Settlements were small and short term. Historically, the area was occupied by Western Abnaki Tribal groups. European settlement

occurred as early as the 17th century and increased during the following centuries. Nineteenth century timber harvesting resulted in a largely deforested landscape by the early 20th century. Tourism and winter and summer recreational activities, began in the 19th century and continue to thrive; combined they are considered the area's number one economy.

Compiled by Northeastern Forest Experiment Station, Northeastern Area State and Private Forestry, and the Eastern Region.

Section M212C—Green, Taconic, Berkshire Mountains

Geomorphology. The Section is part of the New England geomorphic Province. North of central Vermont, the Green Mountains are north to south trending, linear ranges. To the south, they and the Berkshires are highlands characterized by dissected, flat-topped plateaus (up-warped peneplains) with scattered monadnocks. The Taconic Mountains are west of and separated from the southern Green and Berkshire Mountains by a broad, nearly continuous valley (the Marble Valley) about 1,500 ft (460 m) lower than the highlands on either side. The Taconic Mountains contrast with the plateaus to the east



Chittenden Reservoir, Green Mountains, Vermont.

by being more deeply cut into peaks, sharper ridges and canyons with a linear, north to south topographic trend. Scattered glacial features include kames and eskers; the mountains have been smoothed and rounded by glacial scour. Mass wasting, minor karst solution, fluvial erosion, transport and depositions are the primary geomorphic processes operating. Elevation ranges from 600 to 4,000 ft (180 to 1,200 m) with isolated peaks greater than 4,300 ft (1,300 m). Local relief ranges from 1,000 to 3,000 ft (400 to 900 m). Gentle slopes cover less than 20 to 50 percent of the Section; 75 percent occurs in lowlands. Subenvelop elevation ranges from 200 to 1,800 (60 to 550 m).

Lithology and Stratigraphy. Thin, stony Pleistocene till and stratified drift mantle the bedrock. Upper Proterozoic and lower Cambrian metaconglomerate, quartzite, schist, and metavolcanics underlie the northern ranges. Lower Ordovician and Cambrian marble, dolomite, and limestone occupy the long valley. Bedrock in the southern plateaus is mostly Proterozoic gneiss and amphibolite with scattered granitic plutons. Rocks of the Taconic allochthon once rested atop the rocks in the Green Mountains as the whole range was undergoing the tectonic events that created them. During uplift the present Taconic range slid on a plane of weakness, under the force of gravity, to its present position; concomitant folding produced a strong north to south structural grain. Because these rocks were on top, they are mostly of lower metamorphic grade. slate, phyllite, and schist, with lesser quartzite and gneiss.

Soil Taxa. Haplorthods, Haplaquepts, and Dystrochrepts with frigid temperature regime and udic and aquic moisture regimes are most common in the Green and Berkshire Mountains. Cryorthods and Cryaquods with cryic temperature regime and aquic and udic moisture regimes are common at the highest elevations. The Taconic mountains are characterized by Eutrochrepts, Dytrochrepts, and Udipsamments, with mesic temperature regime and udic moisture regime on lower mountain slopes and in the Marble Valley; Fragiocchrepts and Dystrochrepts with frigid temperature regime and udic moisture regime occur at higher elevations.

Potential Natural Vegetation. Küchler vegetation types include northern hardwood, northern hardwood-spruce, and northeastern spruce-fir forest. Regionally-defined important vegetation types include montane spruce-fir, lowland spruce-fir, northern hardwood-conifer, and transition hardwood-conifer.

Fauna. The mountainous regions of western Massachusetts and of southern and central Vermont have undergone tremendous changes in habitat conditions as a result of European settlement, the agrarian nature of that settlement, and continued human occupation of these mountains. The timber wolf and mountain lion were extirpated through land clearing activities and European settlement in the early 1900's. Other large vertebrates such as elk and moose were also eliminated from this region with encroaching settlement. Other species were also greatly reduced by human inhabitants (e.g., beaver), as

have been "noxious" species like the timber rattlesnake. With the re-establishment of forests on abandoned agricultural lands beginning in the late 1800's and early 1900's, many species have expanded to their original distributions. Wolves, mountain lions and elk have not returned. However, moose, beaver, bobcat, and black bear have steadily increased both in range and population with the changing habitat conditions. Efforts to re-establish species like the fisher and wild turkey have also proven successful. Common wildlife species include red-back salamander, red-spotted newt, gray treefrog, ruffed grouse, wood duck, barred owl, yellow-bellied sapsucker, black-capped chickadee, veery, red-eyed vireo, blackpoll warbler, ovenbird, little brown bat, snowshoe hare, northern flying squirrel, red-backed vole, white-tailed deer, and porcupine. No Federally listed threatened and endangered species are unique to this Section.

Climate. Mean annual precipitation is 34 to 52 in (870 to 1,320 mm); mean annual snowfall is 64 to 96 in (1,620 to 2,440 mm). Mean annual temperature ranges from 37 to 45 °F (3 to 7 °C). The growing season lasts for 80 to 130 days.

Surface Water Characteristics. Perennial streams and small lakes provide abundant water. The streams range from low to steep gradients. Channels are generally incised. The headwaters of streams in northern Vermont are located in the piedmont to the east, and the major stream courses are imposed from a previously eroded surface. The principal tributaries to the Hudson River have gentle gradients in upper reaches, underlain by dolomite, limestone, and shale. Streams underlain with shale and graywacke in the Taconics have steep gradients. Average annual runoff ranges from 16 to 40 in (410 to 1,020 mm), increasing locally with elevation. Maximum monthly flows occur in March and April. Extreme peak flows can occur any time of year and are usually associated with hurricanes or rain-on-snow events. Minimum monthly flows occur in August, September, and October.

Disturbance Regimes. This area of New England occupies the lower end on a regional disturbance gradient ranging from relatively frequent occurrence of fire and hurricane winds in southern New England and New England coastal areas to a very low incidence of disturbance in more northern inland sites. Percentage of land in forest continues to increase over time. Composition of present day forest on a landscape scale is heavily influenced by agriculture dating from the colonial period and subsequent farm abandonment from about 1870, as well as by selective logging of certain species, particularly conifers. Although regionally, the distributions of modern and pre-settlement forest types match well, 250 years of land use activity has affected forest structure and composition across the landscape. Insect and disease disturbances have resulted from gypsy moth, spruce budworm, periodic birch and sugar maple defoliators, periodic hemlock looper, ash dieback, and butternut canker. At higher elevations, spruce decline is related to severe winter damage and soil cation depletion.

Land Use. More than 90 percent of this area is forested, with recreation being the dominant land use. Most of the remaining area consists of isolated farms and small residential developments.

Cultural Ecology. Native American hunter-gatherer economics emphasized activities such as hunting-fishing-gathering; quarrying quartzite, and burning to enhance wildlife habitat, promote berry and other understory vegetation, and to facilitate travel. Settlement by Euro-Americans trended south to north from the late 1700's through the early 1800's. Nineteenth century harvesting of softwoods and hardwoods for iron furnace charcoal resulted in a largely de-forested landscape by the early 20th century. Marble extraction and mining of talc and granite were a mainstay in this area during the 19th and 20th centuries. The second half of the 19th century saw a boom in the sheep industry. Western market competition, arrival of the railroads, and new access to urban markets in the decades after the Civil War resulted in a shift from sheep to dairy farming and a move from hill farms and towns to more clustered community settlements, many with out-of-state residents. Tourism and recreation, which began in the 19th century and continue as the area's major economic activities.

Compiled by Northeastern Forest Experiment Station, Northeastern Area State and Private Forestry, and the Eastern Region.

Section M212D-Adirondack Highlands

Geomorphology. The Section is also known as the Adirondack geomorphic Province, but includes a small part of the Appalachian Plateau (Tug Hill Plateau) at the southwest corner. It is a dissected, asymmetrical dome in overall configuration. It is most mountainous, highest, and steepest in the north and east, with lower, rolling hills farther south and west. Local relief exceeds 3,000 ft (915 m). Glaciers covered the dome, producing cirques and other scour features, moraines, lake plains, and a prominent esker system in the north-central area. Tug Hill is a southwest-tilting plateau separated from the Adirondacks by the Black River Valley 1,200 ft (365 m) below the plateau. Mass wasting, fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation extends from 500 to 5,344 ft (150 to 1,630 m); local relief ranges from 1,000 to 3,000 ft (300 to 900 m). Gentle slopes cover 20 to 50 percent of the area; more than 75 percent occurs in lowlands. Subenvelop elevation ranges from 200 to 1,800 (60 to 550 m).

Lithography and Stratigraphy. Thin, stony Pleistocene till, stratified drift, and lacustrine sediments intermittently mantle the bedrock. Proterozoic metamorphic and plutonic rocks (mostly gneiss and highly metamorphosed granite, anorthosite, syenite, and gabbro), which comprise an extension of the Grenville Province of the Canadian Shield, are bedrock in the Adirondacks. Most of the highest mountains are composed of metanorthsite; the

rolling hills are underlain by mixed gneisses. Cambrian sandstone underlies the northern margin of the dome; combined with some Ordovician sediments, it overlies the Proterozoic in small grabens across the dome. Tug Hill is supported by sandstone on top; shale and limestone are exposed in the steep northeast face; shale underlies the valley; all are Ordovician in age.

Soil Taxa. Haplorthods and Haplaquods with frigid temperature regime and udic and aquic moisture regimes comprise most of the Section. Cryorthods and Cryaquods are common at the highest elevations. The southeast portion of the Section is characterized by Dystrochrepts and Fragiochrepts with frigid temperature regime and udic moisture regime.

Potential Natural Vegetation. Küchler vegetation types include northern hardwood-spruce and northeastern spruce-fir forest. Regionally-defined important vegetation types include montane spruce-fir, lowland spruce-fir, northern hardwood-conifer, alpine krummholz, and alpine meadow.

Fauna. Major habitat alterations were associated with intensive logging and human settlement during the late 19th and early 20th centuries. Beaver, fisher, and pine marten were extirpated due to habitat loss and over-harvest. By the late 1800's predators such as lynx, cougar, and gray wolf were extirpated; white-tailed deer, bobcat and black bear were reduced in numbers. Moose were present until the mid-1800's. Other species such as eastern cottontail, gray fox, opossum, and coyote experienced range expansions. Protection and limits on harvest have enabled beaver, marten, and fisher to re-colonize too widely. Moose populations remain small. Southern flying squirrel, star-nosed mole, white-footed mouse, raccoon and white-tailed deer are found in deciduous or mixed forests or meadows and agricultural areas. Eastern pipistrelle, small-footed bat, and big brown bat are winter residents of rocky caves and mines, while the hoary bat and red bat are summer residents. Masked, water, and smoky shrew can be found at most elevations. Meadow vole, rock vole, woodland vole, northern bog lemming, southern bog lemming, red squirrel, and smoky shrew utilize coniferous, deciduous, and mixed forests. Long-tailed shrew and southern red-backed vole are most common in alpine environments. Common merganser, Blackburnian warbler, broad-winged hawk, boreal chickadee, black-throated-green warbler, and black-throated-blue warbler are common. Less common is the gray-cheeked thrush (high elevations) and white-winged crossbills. Acidification related to atmospheric pollution have exerted negative impacts on former brook trout ponds. There are no Federally listed threatened and endangered species unique to this area; there is one known population of the Federally endangered Indiana bat in the Adirondack Park.

Climate. Mean annual precipitation is from 40 to 48 in (1,010 to 1,220 mm) and is evenly distributed throughout the year. Annual snowfall averages from 60 to more than 140 in (1,500 to 3,550 mm), generally increasing with

elevation and with proximity to Lake Ontario. Mean annual temperature ranges from 37 to 45 °F (3 to 7 °C). The growing season lasts from 90 to 150 days, decreasing with increasing elevation.

Surface Water Characteristics. Perennial streams, lakes, and reservoirs provide abundant water. Drainage patterns were imposed upon the basement rock of the Adirondacks during uplift and erosion. The overall stream drainage pattern is radial, but patterns in the central portion are influenced by southwest to northeast trending faults. Stream gradients are low in the interior of the Section and moderate to steep on the perimeter. Waterfalls and rapids occur. Average annual runoff ranges from 20 to 35 in (510 to 890 mm), increasing with elevation. Maximum monthly flow occurs in March and April. Extreme peak flows can occur anytime of year and are usually associated with hurricanes or rain-on-snow events. Minimum monthly flows occur in August, September, and October. Many small lakes and wetlands formed in proglacial deposits. Lake George, the largest lake in the region, (44 mi², 114 km²), is a graben lake.

Disturbance Regimes. Montane spruce-fir and spruce-northern hardwood forests lack significant fire regimes and are characterized by blowdown disturbances from severe wind events and smaller area, single tree phenomenon. Higher elevation forests are often characterized by even-aged windthrow disturbance phenomenon known as fir-waves. Insect and disease disturbances have resulted from gypsy moth, spruce budworm, periodic severe spruce beetle, beech bark disease, and sugar maple defoliators; scleroderis canker on red pine is ongoing. At higher elevations, spruce decline is related to severe winter injury and soil cation depletion. Hardwood-dominated communities are more extensive now than in pre-settlement times due to intensive and selective logging of conifers up to about 1900, followed by fire.

Land Use. More than 90 percent of this area is forested and is used primarily for recreation. Much of the area in the Adirondacks is in a state park. The remaining land area is used for residential development.

Cultural Ecology. Humans have utilized the natural resources of this area for the past 10,000 years. Evidence indicates that the Iroquois avoided settlement within this area but were interested in white pine, hemlock, maple, beech, hickory, and elm for a number of uses. Euro-American settlement occurred as early as the 18th century. By the 19th century, tourism and recreation became the area's major economy.

Compiled by Northeastern Forest Experiment Station, Northeastern Area State and Private Forestry, and the Eastern Region.

Section M212E—Catskill Mountains

Geomorphology. The Section is an inclusion in the northeast corner of the Appalachian Plateau geomorphic Province. Topographically, it is a maturely dissected plateau with a steep, 2,000 to 3,000 foot (610 to 915 m) scarp on its eastern margin (the Catskill Mural Front). It slopes gently westward, where it merges into the hilly landscape that typifies the rest of the Allegheny Plateau. The Catskills have the highest elevations on the plateau. They are characterized by steeply rolling uplands and ridges interlaced with deep ravines. Glaciation is expressed mostly by rounded hilltops and by cirques and other scour features. Mass wasting, fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation ranges from 900 to 4,200 ft (275 to 1,260 m), peak elevations range from 3,000 to 4,200 ft (900 to 1,260 m); subenvelop elevation ranges from 900 to 2,500 ft (270 to 910 m). Local relief is from 1,000 to 3,000 ft (300 to 910 m). Less than 20 percent of area is covered by gentle slopes.

Lithography and Stratigraphy. Bedrock is overlain by Quaternary till or residuum on the ridges and hilltops, colluvium on the slopes, and alluvial materials in the valleys. Sandstone and conglomerate hold up most ridges and high peaks in the Catskills; slopes and valleys are underlain by shale and siltstone. These sediments were deposited during the Devonian period in the eponymous Catskill Delta.

Soil Taxa. Dystrochrepts and Fragiocchrepts with frigid temperature regime and udic moisture regime predominate. Mesic temperature regimes occur in valley bottoms.

Potential Natural Vegetation. Küchler vegetation types include northern hardwood and northern hardwood-spruce forest. Regionally-defined important vegetation types include central hardwoods, transition hardwoods, northern hardwood-conifer, and montane spruce-fir.

Fauna. Common wildlife species include white-tailed deer, white-footed mouse, snowshoe hare, gray squirrel, and white-throated sparrow. The gray-cheeked thrush and blackpoll warbler found in high elevation spruce-fir forests in the Catskill and Adirondack regions are uncommon in other regions. Black bears, bobcats, fishers, and coyotes are the larger predators today. Bird species which characterize this Section are blackburnian warbler, black-throated blue warbler, black-throated green warbler, yellow-rumped warbler, red-eyed vireo, solitary vireo, and hermit thrush. Although black ducks and wood ducks breed in this region, significant numbers of waterfowl are not common. Red-spotted newt, redback salamander, American toad, green frog, gray treefrog, northern spring peeper, spotted turtle, and wood turtle are among the herpetofaunal species which characterize this Section. Northern copperhead and eastern hognose snake, as well as Fowler's toad, can also be found. No Federally listed threatened and endangered species are unique to this Section.



Catskill high peaks in southeastern New York.

Climate. Annual precipitation averages 40 to 48 in (1,020 to 1,230 mm); 60 to 100 in (1,500 to 2,550 mm) occur as snow. Mean annual temperature ranges from 46 to 50 °F (8 to 10 °C). The growing season lasts for 120 to 160 days, decreasing with increasing elevation.

Surface Water Characteristics. Perennial streams and lakes provide an abundance of water. Dendritic drainage dominates; karst features affect local areas. Streams are generally incised. Stream gradients vary from low to steep. Average annual runoff ranges from 25 to 40 in (640 to 1,020 mm). Maximum monthly flows occur in March and April. Extreme peak flows can occur any time of year and are usually associated with hurricanes or rain-on-snow events. Minimum monthly flows occur in August, September, and sometimes October.

Disturbance Regimes. Significant fire regime is absent. Higher elevation spruce-fir forests are characterized by blowdown disturbances from severe wind events and smaller area, single tree mortality. Insect and disease disturbances have resulted from beech bark disease, Dutch elm disease, hemlock wooly adelgid, and chestnut blight, which have resulted in the reduction of some species. Selective logging through about 1880 impacted forest composition. Hemlock, once an abundant species, was selectively logged and has not come back readily.

Land Use. More than 80 percent of this area is in forest land, with farms scattered or absent. The Catskills are used mainly for recreation.

Cultural Ecology. Humans first entered the area during the Paleo-Indian period (about 8,000 to 10,000 B.C.). These people were highly mobile, occupied small, temporary hunting-fishing camps, and hunted wild game. The Archaic period (about 8,000 to 1,000 B.C.) was characterized by changes in human adaptations in response to environmental changes. The climate became warmer, the vegetation changed, and new game fauna proliferated (e.g., deer, elk, and turkey). At the end of the Transitional-Woodland period (about 1,000 to 1,600 A.D.) Mohican Tribal groups inhabited the area. By 1700, the Mohicans moved higher up into the mountains to avoid the expansion of European settlement and returned to hunting-gathering pursuits. By the 19th century, timber had been harvested, and a number of other natural resources had been exploited over much of the area.

Compiled by Northeastern Forest Experiment Station, Northeastern Area State and Private Forestry, and the Eastern Region.

Province 221–Eastern Broadleaf Forest (Oceanic)

Nine Sections have been delineated in this Province: 221A–Lower New England; 221B–Hudson Valley; 221C–Upper Atlantic Coastal Plain; 221D–Northern Appalachian Piedmont; 221E–Southern Unglaci­ated Allegheny Plateau; 221F–Western Glaci­ated Allegheny Plateau; 221H–Northern Cumberland Plateau; 221I–Southern Cumberland Mountains; and 221J–Central Ridge and Valley. These Sections are located in the eastern conterminous States, including parts of Tennessee, Kentucky, West Virginia, Ohio, Pennsylvania, New York, New Jersey, Rhode Island, Massachusetts, New Hampshire, and Maine. The area of these Sections is about 104,500 mi² (270,650 km²).

Section 221A–Lower New England

Geomorphology. The Section comprises parts of the New England, Piedmont, and Coastal Plain geomorphic provinces. Cape Cod and Long Island are large terminal moraine complexes modified by coastal processes. Glacial features such as small to large delata plains, lacustrine basins, eskers, and extensive drumlin fields are widespread. The Section gradually descends in a series of broad, hilly plateaus to the coastal zone. Central Connecticut and western Massachusetts are characterized by a north to south trending basin, a lowland plain, punctuated with a central linear ridge. Primary geomorphic processes are coastal and fluvial erosion, transport and deposition, and mass wasting. Elevation ranges from sea level to 1,500 ft (450 m). Some high hills (monadnocks) are 2,000 ft (600 m). Local relief ranges from 100 to 1,000 ft (30 to 300 m). Gentle slopes cover less than 20 to 80 percent of the area; 50 to 75 percent are in lowlands. Subenvelop elevation ranges from 0 to 650 ft (0 to 200 m).

Lithology and Stratigraphy. Surficial geology is Pleistocene age. In the northeastern part, coastal lowlands are covered by glacial marine sediment (mostly clay). Thin, stony till and glacial fluvial and glacial lacustrine sediment overlie bedrock inland. Cape Cod, Long Island, and Block Island are composed of thick, morainal and outwash sediment. The bedrock geology is varied and complex. Intense, northeast to southwest trending, faulting, and folding, and plutonic and volcanic episodes have resulted in variegated sedimentary, igneous, and metamorphic rocks. Triassic-Jurassic red conglomerate, sandstone and shale (the north to south trending lowland), with a prominent diabase sill (the linear ridge); Carboniferous sandstone, conglomerate, shale and dolostone; Paleozoic granites and volcanics; lower Paleozoic and Proterozoic quartzite, marble, schist, gneiss, and greenstone; and massive Proterozoic granite,

granodiorite, diabase, and gabbro. Minimum elevations range from about 200 ft (61 m) in the north to near sea level south of Long Island Sound. Maximum local elevations are generally under 500 ft (152 m) but range to 1,000 ft (305 m). Gentle slopes cover 50 to 80 percent of the area; 50 to 75 percent occurs in uplands.

Soil Taxa. Interior Section taxa include Dystrochrepts and Haplaquepts with udic and aquic moisture and mesic temperature regimes. Coastal regions, (e.g., Cape Cod and Long Island) are characterized by Udorthents and Udipsamments with mesic temperature and udic moisture regime. Sulphemists, Sulfaquents, and Medisaprists are also common near coastal areas.

Potential Natural Vegetation. K uchler vegetation types include northern hardwood, Appalachian oak, and northeastern oak-pine forest. Regionally-defined important vegetation types include northern hardwood-hemlock-white pine, central hardwoods, coastal pitch pine, maritime oak, and maritime red cedar.

Fauna. Drastic disturbance of the original ecosystems and their faunal component resulted from European settlement. Major predators (e.g., timber wolf) were intentionally exterminated. Other large vertebrates were exterminated (e.g. moose), reduced, or restricted (e.g., white-tailed deer, wild turkey) by hunting and habitat loss. Original distributions were re-established or exceeded for some species with the re-establishment of forests on abandoned agricultural lands, in some cases, with higher population densities. The large predators have not returned; their niche has been partially filled by mid-size predators (e.g., bobcat, coyote). This ecological shift, combined with hunting access restrictions, has resulted in imbalances between herbivores and plant resources. Extensive areas of regenerating forest and associated early successional habitat are lacking. Hard tree mast (i.e., acorns, beechnuts) drives many faunal processes. Common wildlife species include the white-tailed deer, gray squirrel, white-footed mouse, red-eyed vireo, and red-spotted newt. Restoration of historical Atlantic salmon in the Connecticut and Merrimack Rivers is ongoing. No Federally listed threatened and endangered species are unique to this area.

Climate. Precipitation, which ranges from 35 to 50 in (820 to 1,270 mm), is evenly distributed throughout the year. Snow increases with elevation; amounts vary from 36 to 100 in (915 to 2,540 mm) of snow increasing with elevation. Mean annual temperature ranges from 45 to 50 °F (7 to 10 °C). The growing season lasts for 120 to 180 days.

Surface Water Characteristics. Abundant water resources include perennial streams, natural and artificial lakes and ponds, fresh and saltwater wetlands, and estuaries. Streams exhibit deranged, dendritic, and trellis patterns due to a complex geomorphic history of stream imposition, differential weathering, glaciation, continental rebound, and stream capture. Stream gradients are generally low but steepen locally near the Connecticut River and in areas approaching the uplands and mountains. Average annual runoff ranges from 18 to 24 in (460 to 610 mm). Maximum monthly streamflows occur in March and April. Extreme peak flow may occur any time of year and usually are associated with hurricanes or rain-on-snow events. Minimum monthly flows occur in August, September, and October. Most lakes and impoundments are small. The exceptions are Lake Winnepesaukee (72 mi², 186 km²) and Squam Lake (11 mi², 29 km²) in New Hampshire, Sebago Lake (45 mi², 116 km²) in Maine, and the Quabbin Reservoir (37 mi², 96 km²) in Massachusetts.

Disturbance Regimes. Central and coastal New England have intermediate to high occurrences of fire and hurricane winds (thirty to fifty years) relative to inland New England sites. Tidal flooding associated with storms occurs along the coast. Regionally, the distribution of modern and pre-settlement forest types match well. At a landscape scale, modern forest characteristics are strongly controlled by land use, particularly agriculture dating from colonial time and subsequent farm abandonment from about 1850. Insect and disease disturbances result from gypsy moth, beech bark disease, chestnut blight, Dutch elm disease, hemlock woolly adelgid, periodic pitch pine and hemlock looper, oak leaf tier damage, and red pine scale and adelgid.

Land Use. Forest land dominates 70 percent of the area, mostly in small holdings; residential uses increase concern over parcelization and fragmentation. About 15 percent of the area is in agricultural use and about 10 percent is urbanized.

Cultural Ecology. Many Native American tribes settled and hunted, fished, and farmed the land before European settlement in the early 1600's. Transportation and commerce are significant cultural influences. The Atlantic Ocean, rivers, and railroads provided early transportation routes. Fishing, whaling, shipbuilding industries, ironworks, tanneries, and textile mills decreased in importance following the 1800's. Metal-working and machining are important today. Sand, gravel, clay, granite, limestone, and marble are mined. Agriculture decreased as manufacturing increased. Historic and resource based tourism are important economic sectors.

Compiled by Northeastern Forest Experiment Station, Northeastern Area State and Private Forestry, and the Eastern Region.

Section 221B–Hudson Valley

Geomorphology. The Section is the northernmost extension of the Ridge and Valley geomorphic province. It is characterized by a linear lowland, a glacial lake plain in part, bounded on either side by high escarpments. The lowland was created by graben-faulting, easily eroded bedrock, and glacial scour. Fluvial erosion, transport and deposition, and mass wasting are the primary geomorphic processes operating. Minimum elevations range from about 200 ft (61 m) in the north to near sea level south of Long Island Sound. Maximum local elevations are generally under 500 ft (152 m) but range to 1,000 ft (305 m). Gentle slopes cover 50 to 80 percent of the area, 50 to 75 percent occurs in uplands.

Lithology and Stratigraphy. The northern half of the central lowland is covered by Pleistocene lacustrine sediments; the remainder is covered by Quaternary alluvium. The uplands have thin, stony till over bedrock. Ordovician carbonate, shale, siltstone, and sandstone form bedrock in the lowlands. Uplands to the east are Ordovician-Cambrian metasediments and metavolcanics; to the west are Silurian conglomerates and Devonian limestones.

Soil Taxa. Dystrochrepts and Fragiocchrepts with udic moisture regime and mesic temperature regime are most common in the lower Hudson River valley and along the margin of the Catskill and Taconic Mountains. Hapludalfs with mesic temperature regime and udic moisture regime are more common in the upper valley.

Potential Natural Vegetation. Kùchler vegetation types include northern hardwood and Appalachian oak forest. Regionally-defined important vegetation types include central hardwoods, transition hardwoods, and northern hardwoods grading from south to north. Albany sand plains support pitch pine-scrub oak communities.

Fauna. With European settlement, the original forest ecosystems and their forest-dependent fauna were reduced to marginal areas. With the re-establishment of forest on abandoned agricultural lands, many forest wildlife species have returned to their pre-settlement distributions and numbers. Large predators have not re-established themselves, either naturally or by re-introductions; and the reduced predation on major herbivores, especially white-tailed deer, has resulted in an increasingly widespread problem. Acorns are an important resource of forest habitats, providing an energy source that drives many wildlife processes. Fragmentation of forest cover by residential development is an important concern. Excessive deer populations are a major wildlife problem. Deer damage domestic plants and agricultural crops, destroy natural forest regeneration, and cause motor-vehicle accidents. Common wildlife species include white-tailed deer, gray squirrel, white-footed mouse, red-eyed vireo, and red-spotted newt. No Federally listed threatened and endangered species are unique to this area.

Climate. Average annual precipitation is 40 in (1,020 mm). Average annual snowfall is from 40 to 60 in (1,020 mm).

to 1,520 mm). Average annual temperature ranges from 45 to 50 °F (7 to 10 °C). The growing season lasts for 160 to 180 days.

Surface Water Characteristics. The Hudson River and its tributaries dominate the unit. Perennial streams, small lakes, and fresh water and saltwater wetlands occur. The Hudson River is a low gradient incised stream. Major tributaries from the Taconics and Allegheny plateau have moderate and steep gradients. Under natural conditions, daily saltwater tides in the Hudson River would reach as far upstream as Albany, New York. Average annual runoff ranges from 10 to 22 in (250 to 560 mm). March and April are the months of highest streamflow. Lowest streamflow occurs in August.

Disturbance Regimes. This region generally lacks large-scale natural disturbance regimes; however, fire is an important small-scale disturbance in the maintenance of pitch pine-scrub oak communities on sand plains and ridges along the middle to lower Hudson River Valley. In general, forest land occurs on edaphic extremes, i.e., steep, shallow, or otherwise unsuitable land for farming or settlement. All forest land is in second or third growth. Insect and disease disturbances have resulted from chestnut blight, Dutch elm disease, beech bark disease, butternut canker, and ongoing woolly adelgid infestation.

Land Use. Roughly 60 percent of this area is in forest, but with minimal forest land adjacent to the river and its urbanized corridor. The remaining land area is in urban, residential, and agricultural use.

Cultural Ecology. Native American occupation and ecological exploitation began as early as 10,000 years ago. These early inhabitants evolved from mobile, nomadic hunting groups to more sedentary groups, adapting to subsistence-based farming and hunting. European exploration began in the 1600's. The fur trade was a prominent activity in the area during the latter 17th and early 18th centuries. Settlement of towns and cities increased in the 19th century in response to the growing shipping industries along the Hudson River and banks of Lake Champlain. Today, a vast number of industries provide employment for the area's dense population.

Compiled by Northeastern Forest Experiment Station, Northeastern Area State and Private Forestry, and the Eastern Region.

Section 221C—Upper Atlantic Coastal Plain

Geomorphology. The Section is part of the Coastal Plain geomorphic province. It is characterized by a series of moderately dissected, northeast to southwest trending terraces that get progressively lower toward the coastline. It has a prominent lowland that forms its northwest border. The coastline is characterized by dune fields, beaches, lagoons, embayments, and barrier islands. Drainage is dendritic; coastal and fluvial erosion,

transport and deposition are the primary geomorphic processes operating. Elevation ranges from 0 to 300 ft (0 to 100 m). Most of the area is less than 150 ft (50 m).

Lithology and Stratigraphy. The series of terraces is composed of progressively younger sediment layers that range from poorly-defined to unconsolidated: interbedded mud, silt, sand and gravel. The oldest units, Cretaceous in age, are exposed farthest landward in the Section; progressively younger terraces of Tertiary and Quaternary age occur toward the Atlantic and Delaware Bay. The border lowland is covered by Quaternary sediments as well, deposited since the end of Pleistocene glaciation.

Soil Taxa. Mostly Udults and Aquults with udic and aquic moisture regimes. Quartzipsamments with xeric to aquic moisture regimes are locally important, especially in the pine barrens. Essentially all soils have a mesic temperature regime.

Potential Natural Vegetation. Küchler's map shows mostly northeastern oak-pine forest, with some oak-hickory-pine forest adjacent to Delaware Bay, and some fringes of northern cordgrass prairie along the Atlantic coast. Braun's discussions tell of cedar bogs with transition pine forests and deciduous swamps. There are also pine plains and grassy savannas, especially in the pine barrens area.

Fauna. Historical records indicate that the black bear, wolf, and cougar once inhabited the area. Evidence also indicates that the American bison roamed the region. Today only black bear are present south of the New Jersey Turnpike. Present examples of open-land wildlife include quail, meadowlark, field sparrow, doves, cottontail rabbit, red fox, and woodchuck. These species occur in areas of open lands, such as crop land, pastures, meadows, lawns, and in areas overgrown with grasses, herbs, and shrubs. Among the birds and mammals that prefer woodlands are ruffed grouse, woodcock, various thrushes and vireos, gray and red squirrels, gray fox, white-tailed deer, and raccoon. They obtain food and cover in stands of hardwoods, coniferous trees, shrubs, or a mixture of these vegetative types. Ducks, geese, rails, herons, shore birds, beaver, mink, and muskrats are found in ponds, marshes, and swamps.

Climate. Precipitation ranges from 42 to 45 in (1,060 to 1,140 mm). Most precipitation falls near the coast in summer. Snowfall ranges to 30 in (750 mm). Temperature ranges from 50 to 55 °F (10 to 13 °C). The growing season lasts for 240 to 250 days.

Surface Water Characteristics. Streams flow relatively slowly to the Atlantic Ocean or the Delaware Bay. Natural lakes are rare to non-existent. Small water impoundments are common along the upper reaches of streams. Bogs, swamps, and salt marshes exist along the Atlantic Coast. Bogs tend to be very acidic, mainly in the soils of the pine barrens. Bogs also occur as narrow belts along streams in the Pine barrens and Cape May

areas. Rates of streamflow near Delaware Bay and the coast fluctuate daily in response to tides. Tests show that salt content is sufficiently low that tidewater from streams may be used for irrigation without adverse effects on soils and vegetation. Currently, there is ample water for farm, urban, and industrial uses. However, urban development is having increasingly affecting the hydrology of the area, including infiltration, underground water storage, and runoff.

Disturbance Regimes. Historically, fire was a significant natural disturbance. Most of the vegetative types owe their existence to repeated fires. Other disturbances include bog-iron mining; construction of ore furnaces; utilization of clay deposits and glass sands; and logging. Early sawmills were driven by water power. Cedar bogs were exclusively logged which resulted in an increase in deciduous swamps. The cranberry industry caused the construction of small dams, sluice gates, and ditches to facilitate drainage. Although peat was low grade, some harvesting did take place.

Land Use. The primary land uses currently are forests, agriculture, pasture, and urban development. Cultivated plants include fruit trees; bush fruits and vines; leaf crops; fodder and cereal; flowers; and root and garden crops.

Cultural Ecology. Humans have utilized the natural resources of this area for the past 10,000 years. This Section comprises part of the historic home of the Delaware Tribe. Marine resources have been of particular interest to occupants in this area throughout time. Euro-American settlement occurred as early as the 18th century. By the latter 19th century, industrialization, increased population, marine-related industries and the development of coastal resorts, such as Atlantic City, had made their mark on the natural ecology of the area and were the major sectors of the area's economy.

Compiled by Northeastern Area, State and Private Forestry and the Eastern Region.

Section 221D—Northern Appalachian Piedmont

Geomorphology. The Section comprises part of the Piedmont geomorphic province. Most of the Section is a maturely dissected peneplain, sloping gently toward the coast. It is hilly to rolling terrain with a few high ridges, where local relief can be up to 1,200 ft (365 m). The Section is crossed southwest to northeast by a broad, structural basin forming a lowland plain, an extension of the one noted in Section 221A. Drainage is dendritic; fluvial erosion, transport and deposition, and mass wasting are the primary geomorphic processes operating. Elevation ranges from 80 to 1,650 ft (25 to 500 m). The predominant elevation ranges from 300 to 1,000 ft (100 to 300 m).

Lithology and Stratigraphy. Bedrock is overlain by residuum on the ridges and hill tops, colluvium on the

slopes, and alluvial materials in the valleys. The youngest bedrock in the Section occupies the structural basin: Triassic and Jurassic redbeds (conglomerate-sandstone-shale), basalt flows and diabase sills; the basalt and diabase hold up the few high ridges. Bedrock in the remainder is composed of mixed metamorphics (marble, quartzite, slate, schist, gneiss) of Proterozoic to lower Paleozoic age. Saprolite (deeply weathered bedrock) commonly covers these latter units. Other rocks intrusive in the pre-Cambrian metamorphic basement rocks were pegmatite dikes, serpentine, metadiorite, and gabbro.

Soil Taxa. Soils include Udults, Udalfs, and Ochrepts. The dominant moisture regime is udic. The temperature regime is mesic. Soils are dominantly well drained, and range from moderately deep to deep. Dominant soils on stream floodplains are Dystrochrepts and Fluvaquents.

Potential Natural Vegetation. Prior to Euro-American settlement in the early 17th century, the native vegetation consisted mainly of oak and hickory. Chestnut, yellow-poplar, ash, walnut, and elm were associated species. Maple was dominant on the wet bottomlands of the Piedmont area. Currently Appalachian oak forest (Küchler) and sugar maple-mixed hardwoods, hemlock-mixed hardwoods, oak-chestnut (Braun) dominate.

Fauna. Historical records indicate that the black bear, wolf, and cougar once inhabited the area. Evidence also indicates that the American bison roamed the region. Relatively fertile soils result in very diverse habitats. Examples of open land wildlife are meadowlark, field sparrow, dove, cottontail rabbit, red fox, and woodchuck, which are found in areas of crop land, pastures, meadows, and lawns in areas overgrown with grasses, herbs, and shrubs. Among the birds and mammals that prefer wood lands are the ruffed grouse, woodcock, various thrushes and vireos, scarlet tanager, various woodpeckers, gray and red squirrels, gray fox, white-tailed deer, and raccoon. They obtain food and shelter in stands of hardwoods, coniferous trees, shrubs, or in mixtures of these types. Ducks, geese, herons, shore birds, mink, and muskrats are found in ponds, marshes and swamps.

Climate. Precipitation averages between 39 to 47 in (1,000 to 1,200 mm). Most falls in spring and early summer. Snowfall ranges from 27 to 40 in. (680 to 1,000 mm). Temperature ranges from 40 to 55 °F (5 to 13 °C). The growing season lasts for 160 to 250 days.

Surface Water Characteristics. This Section is generally characterized by a mature, dendritic drainage network. Natural lakes are rare to non-existent, except in the northeastern extremity of the Section, which was covered by Pleistocene glaciation. Small impoundments are common along upper reaches of streams. A few bogs, swamps, and salt marshes occur in areas adjacent to the Atlantic coast and Chesapeake Bay. The lower extremities of some of the major streams are affected by tides. There is ample water for farm, urban, and industrial uses. Urban development is affecting water

yields. Good ground water recharge areas are being impacted by encroaching development.

Disturbance Regimes. Historically, fire was a significant natural disturbance. Gypsy moth and chestnut blight have had effects on the vegetation.

Land Use. Farms, wood lands, and industrial and urban development are the major current land uses.

Cultural Ecology. As early as 10,000 years ago, Native Americans hunted a variety of animals and gathered many plant varieties. This is part of the historic home of the Delaware Tribe. Euro-American settlement occurred as early as the 18th century, beginning with Britain immigrants. By the latter 19th century, industrialization, increased population, and the development of large metropolitan cities, such as Philadelphia, had made a mark on the natural ecology of the area.

Compiled by Northeastern Area State and Private Forestry and Eastern Region.

Section 221E—Southern Unglaciaded Allegheny Plateau

Geomorphology. This Section comprises part of the Appalachian Plateaus geomorphic province. It is a maturely dissected plateau characterized by high hills, sharp ridges, and narrow valleys. An exception is the broad Teays Valley, created by a major, preglacial river. The valley was dammed by an ice sheet during the Pleistocene and abandoned by the river after the melt. Local relief in the Section exceeds 2000 ft (610 m) along the New River Gorge, but is generally much less. Drainage is dendritic; mass wasting, karst solution, and fluvial erosion, and transport and deposition are the primary geomorphic processes operating. A notable but very minor landform is anthropogenic. lands that have been strip-mined exhibit hummocky or gouged topography. Elevation ranges from 650 to 1,300 ft (200 to 400 m). Local relief is generally about 160 to 325 ft (50 to 100 m).

Lithology and Stratigraphy. Bedrock is overlain by Quaternary residuum on the ridges and hilltops, colluvium on the slopes, and either or both alluvium and Pleistocene lacustrine materials in the valleys. The youngest bedrock units lie at the center of the Section, in a large southwest to northeast trending oval, and consist of Permian sandstone, siltstone, and shale with minor limestone and coal. Exposed around the Permian oval are units of the Pennsylvanian System, similar in lithology to the Permian rocks but containing major coal beds. The Mississippian sandstone, shale, and limestone are exposed around the margins of the Pennsylvanian outcrop. Devonian black shale with minor sandstone composition crops out around the southwest and northern margins of the Section. This outcrop pattern describes a structural basin, one which was subsiding through most of the Paleozoic Era.



A characteristic dissected landscape of the Southern Unglaciaded Allegheny Plateau Section.

Soil Taxa. Udalfs, Udults, and Ochrepts dominate, in combination with mesic soil temperature regime, an udic soil moisture regime, and mixed or illitic mineralogy. Soils formed in parent materials divided into five groups: residual material, which developed in place by the weathering of underlying bedrock; colluvial material which weathered from bedrock strata transported by water and gravity to the lower slopes; alluvium, lacustrine sediments, and outwash deposited by water; loess deposited by wind; and mine spoil in areas that have been strip-mined for coal.

Potential Natural Vegetation. Küchler types are mapped as mixed mesophytic forest and Appalachian oak forest. Other recognized communities include mixed oak forest, oak-hickory-chestnut forest, oak-pine forest, hemlock forest, beech forest, floodplain forest and swamp forest.

Fauna. Current mammal populations are typified by the white-tailed deer, gray fox, woodchuck, opossum, gray squirrel, white-footed mouse, and short-tailed shrew; more rare are the hairy-tailed mole, smoky shrew, and the rare eastern woodrat. The bison, elk, black bear, mountain lion, timber wolf, and bobcat, once common historically, were extirpated (except for small numbers of black bear and bobcat). Common birds in this Section include the wild turkey, ruffed grouse, barred owl, pileated woodpecker, eastern phoebe, blue-gray gnatcatcher, Acadian flycatcher, white-eyed vireo, ovenbird, Kentucky warbler, yellow-breasted chat, and summer tanager. Some amphibians and reptiles which typify this Section include the red-spotted newt, dusky salamander, fence lizard, American toad, wood frog, box turtle, snapping turtle, painted turtle, ringneck snake, northern water snake, black rat snake, and copperhead. Rare reptiles include the timber rattlesnake and green salamander.

Prior to 1850, the Ohio River and its tributaries in this Section contained large numbers of fishes and mussels. Historic records show large catches of muskellunge, sturgeon, catfish, buffalo, drum, spotted bass, walleye, and sauger occurred. The fish assemblage in this Section is typical of the headwater stream to large river habitats, while southern redbelly dace, creek chub, barred fantail darter, and greenside darter are common in smaller streams. Black basses, sunfish, sauger, and catfish, the hybrid saugeye, and striped bass are common in the Ohio River and lower portions of its tributaries. Largemouth bass, bluegill, channel catfish, and crappie are found in the large, man-made reservoirs in this Section. One numerous mussel populations have decreased greatly; many are on State and Federal threatened and endangered species lists.

Climate. Precipitation averages 35 to 45 in (900 to 1,150 mm); it occurs mainly during summer, winter, and spring. Rain on snow is common during winter and early spring. Summers are dry with low humidity. Temperature averages 52 °F (11 °C). The growing season 120 to 180 days

Surface Water Characteristics. Although not covered by ice, this Section was dramatically affected by glaciers. Three major preglacial streams drain the area and many of their tributaries were eventually blocked by the advancing ice sheets. Lakes were created in the valleys, into which considerable sediments were deposited, which later drained as ice sheets receded. The present drainage system is the result of complicated drainage re-arrangements over long periods of time, with the elimination of all natural lakes in the Section and the creation of a new master drainage system of the Section to the Ohio River. This Section is characterized by a relatively high density of streams, with gradients ranging from high, steep headwaters streams to low gradient rivers that flow into the Ohio River. Some streams are underlain by relatively shallow silt, sand, or gravel alluvium, while others in the preglacial valleys are filled with deep glacial deposits. Bedrock is frequently

exposed and consists of limestone, siltstone, sandstone, shale, and numerous coal seams. Small springs are numerous, but most are ephemeral. Natural streamflow and water quality characteristics have been greatly modified by oil, gas, and coal extraction activities.

Disturbance Regimes. Historically, low-intensity fires probably occurred at a given site at five to 10 year intervals. Fires of higher intensity occurred at intervals of up to 50 years. Dry ridges and slopes facing south to west burned more frequently than moist creek bottoms and slopes facing north to east. Annual spring flooding occurred annually to some degree along major rivers. The forests were probably affected locally by insect and tree diseases. Climatic-influenced disturbances included winter ice storms, occasional tornadoes, and periodic flooding along major river floodplains. Natural disturbances to the streams and rivers include floods and droughts. Man-made disturbances to streams include channelization, construction of locks and dams, and input of industrial waste, sewage, mining wastes, and soil.

Land Use. About half of this area is forested, and the sale of wood fiber is important in some parts. Urban expansion, including industrial developments, is increasing along the Ohio River and its major tributaries. Since the time of settlement, lands which are level enough for agriculture have been cleared, especially on ridgetops and creek bottoms. Sites with either or both poor soils and severe erosion were abandoned and left to natural succession or planted with trees or grasses and forbs. Most slopes have been repeatedly logged. Strip mining for coal and oil and gas exploration and production continue throughout the Section.

Cultural Ecology. Paleo-Indians, nomadic peoples who hunted Pleistocene megafauna, were the first humans to reach the Ohio Territory approximately 12,000 years ago. Continual glacial recession and a warming climate resulted in a more deciduous and diverse environment. During the Archaic Period (about 8,500 to 1,000 B.C.) floral resources and a variety of small game animals were exploited. Rudimentary horticultural activities and early ceremonialism began to emerge. The Woodland Period (about 1,000 B.C. to 1,000 A.D.) was characterized by more sedentary lifestyles which involved the development of agricultural practices. Extensive trade networks of local and exotic resources were established. Later a shift occurred toward large settlements dependent on maize agriculture. The Fort Ancient Period (about 1,000 to 1,600 A.D.) was typified by increased sedentary culture. Large floodplain villages often organized around central plazas, upland hunting camps, and an influx of southern Mississippian influences. Europeans reached the Ohio Territory around 1,650 A.D. Settlement initially consisted of farming communities; later, emphasis shifted to extractive industries such as coal, iron ore, clay, oil and gas, and, sandstone.

Compiled by Eastern Region.

Section 221F—Western Glaciated Allegheny Plateau

Geomorphology. The Section comprises part of the Appalachian Plateaus geomorphic province. It is a maturely dissected upland modified by glaciation. It is characterized by rounded hills, ridges, and broad valleys. Glacial features include valley scour, ground moraines, kames, eskers, and kettled outwash plains. Drainage is dendritic; mass wasting and fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation ranges from 650 to 1,000 ft (200 to 300 m). Local relief ranges from 6 to 50 ft (2 to 15 m).

Lithology and Stratigraphy. Thin Pleistocene till and stratified drift mantle many upland bedrock surfaces; lower slopes are covered by colluvium; alluvium and glacial lacustrine materials cover valley floors. Bedrock beneath the drift consists of Devonian shale, siltstone, sandstone and minor conglomerate; Mississippian sandstone and siltstone; and Pennsylvanian sandstones, shales, and coal.

Soil Taxa. Dominant soils are Udalfs, Aqualfs, and small areas of Udults in combination with mesic temperature regimes, and udic or aquic soil moisture regimes and mixed or illitic mineralogy. Soils formed in parent materials divided into six groups: residual material, which developed in place by the weathering of underlying bedrock; colluvial material which weathered from bedrock strata transported by water and gravity to the lower slopes; alluvium, lacustrine sediments, and outwash deposited by water; loess deposited by wind; glacial till deposited by ice; and mine spoil in areas that have been strip-mined for coal.

Potential Natural Vegetation. Kuchler types are mapped as beech-maple forest, Appalachian oak forest, northern hardwood forest, mixed mesophytic forest, and a small extent of oak-hickory forest. Other recognized types include maple-ash-oak swamp forest, wet beech forest, beech-sugar maple forest, oak-maple forest, and mixed oak forest.

Fauna. Common mammals in this Section today include the white-tailed deer, red fox, woodchuck, raccoon, opossum, striped skunk, cottontail rabbit, fox squirrel, long-tailed weasel, eastern chipmunk, short-tailed shrew, and meadow jumping mouse. The less common masked shrew and hairy-tailed mole are also characteristic of this Section. The bison, elk, black bear, mountain lion, timber wolf, bobcat, and porcupine were all common historically but have since been extirpated, except for small numbers of black bear and bobcat. Current bird populations are typified by the red-tailed hawk, great-horned owl, belted kingfisher, northern flicker, great crested flycatcher, white-breasted nuthatch, eastern bluebird, gray catbird, American redstart, scarlet tanager, chipping sparrow, and ruby-throated hummingbird. The wood duck, beaver, and white-tailed deer are three animals in this Section

which have made dramatic recoveries in the 20th century after being extirpated (or nearly so) in the past. Some amphibians and reptiles which are common in this Section include the dusky salamander, American toad, spring peeper, snapping turtle, painted turtle, northern water snake, garter snake, smooth green snake, and milk snake. The common shiner, mottled sculpin, brook stickleback, horneyhead chub, and western lake chubsucker are examples of some of the stream fishes occurring in this Section. Largemouth bass, bluegill, channel catfish, and crappie are found in the large, man-made reservoirs in this Section.

Climate. Precipitation averages 35 to 40 in (900 to 1,020 mm) fairly evenly distributed throughout the year, but slightly higher in spring and early summer and lowest in winter. Average annual temperature is about 50 °F (10 °C). The growing season averages about 160 days.

Surface Water Characteristics. A major water divide occurs in this Section separating water flowing to the gulf of St. Lawrence from water flowing to the Gulf of Mexico. Stream gradients range from steep, headwater streams to low-gradient rivers that flow into the Ohio River, and a portion that flows into Lake Erie. Streams are underlain by deep coarse sand and gravel glacial outwash. Small natural lakes and wetlands (either or both bogs and marshes) are features of the glaciated landscape. Small artificial ponds occur on many farms. Several large reservoirs occur along perennial streams.

Disturbance Regimes. Forests in the more rugged ravines and on dissected slopes were locally affected by insect and tree diseases and windstorms. The terraces and flood plains were also affected to some extent by large animals, insect and tree diseases, windstorms, droughts, and fires, but these impacts were less severe. Beaver also affected the flood plains along streams by building dams that sometimes killed relatively large stands of trees and created temporary ponds. Natural disturbances to the streams and rivers are floods and droughts. Man-made disturbances to streams in this Section include channelization, construction of dams, and input of industrial waste, sewage, and soil.

Land Use. About 50 percent of the Section is used for agricultural purposes. About 25 percent is forested, half of which is small wood lots.

Cultural Ecology. Paleo-Indians, nomadic peoples who hunted Pleistocene megafauna, were the first humans to reach the Ohio Territory approximately 12,000 years ago. Continual glacial recession and a warming climate resulted in a more deciduous and diverse environment. During the Archaic Period (about 8,500 to 1,000 B.C.) floral resources and a variety of small game animals were exploited. Rudimentary horticultural activities and early ceremonialism began to emerge. The Woodland Period (about 1,000 B.C. to 1,000 A.D.) was characterized by more sedentary lifestyles which involved the development of agricultural practices. Extensive trade networks of

local and exotic resources were established. Later a shift occurred toward large settlements dependent on maize agriculture. The Fort Ancient Period (about 1,000 to 1,600 A.D.) was typified by increased sedentary culture. Large floodplain villages often organized around central plazas, upland hunting camps, and an influx of southern Mississippian influences. Europeans reached the Ohio Territory around 1,650 A.D. Settlement initially consisted of farming communities; later, emphasis shifted to extractive industries such as coal, iron ore, clay, oil and gas, and, sandstone.

Compiled by Eastern Region.

Section 221H-Northern Cumberland Plateau

Geomorphology. This Section is in the Appalachian Plateaus geomorphic province. Broad uplift of strata gently-dipping strata to a level-bedded plateau, followed by fluvial erosion and mass wasting, has resulted in a moderately dissected region of dendritic drainages. Landforms on about 80 percent of the Section consist of high hills. Other landforms in the southern part of the Section are about equal areas of tablelands and open low mountains. Elevation ranges from 1,270 to 2,000 ft (380 to 600 m). Local relief ranges from 50 to 100 ft (15 to 30 m).

Lithology and Stratigraphy. Rocks in this Section formed during the Paleozoic Era and strata consist mostly of Pennsylvanian marine sediments (sandstone, shale, coal, and limestone).

Soil Taxa. Soils are mostly Udults, with about 20 percent of the area in Ochrepts. Hapludults and Fragiudults are on side slopes and ridges. Dystrochrepts are in colluvium and Fluvaquents are on flood plains. These soils have a mesic temperature regime, an udic moisture regime, and mixed or siliceous mineralogy. Soils are medium to fine textured, shallow to deep, and generally have adequate moisture supply to support vegetation during the growing season.

Potential Natural Vegetation. Küchler classifies vegetation as mixed mesophytic forest and Appalachian oak forest. The predominant vegetation form is cold-deciduous broad-leaved forest with evergreen needle-leaved trees. The shortleaf pine-oak forest cover type dominates much of this Section in Kentucky. The oaks on drier sites include post, southern red, scarlet, and blackjack; on moister sites, white and black oaks predominate. In Tennessee, the same oaks are present, but pines are not a dominant overstory component. Hickories, including pignut, mockernut, shagbark, and bitternut, form a common but minor component.

Fauna. The primary game animals and furbearers of the region are the white-tailed deer, gray fox, bobcat, raccoon, mink, muskrat, and gray squirrel. Black bears, once found throughout the Section, are now beginning to return after many years of absence. Some common and characteristic small mammals of forested habitats include the smoky shrew, pygmy shrew, short-tailed shrew, white-footed mouse, pine vole, and woodland jumping mouse.



A relatively low relief landscape characteristic of the Central Till Plains, Beech-Maple Section.

The sandstone cliff lines and associated rock shelters are used by the eastern spotted skunk, Allegheny wood rat, northern long-eared bat, Rafinesque's big-eared bat, and the Virginia big-eared bat. The wild turkey and ruffed grouse are the two principal game birds of the Section; some characteristic songbirds include the solitary vireo, blue-winged warbler, black-throated green warbler, cerulean warbler, black and white warbler, American redstart, worm-eating warbler, ovenbird, and hooded warbler. The reptile fauna is quite varied; the northern copperhead, eastern garter snake, northern ringneck snake, black rat snake, five-lined skink, and eastern box turtle are frequently seen. Common amphibian species are the green salamander, Kentucky spring salamander, Black Mountain salamander, seal salamander, slimy salamander, spotted salamander, American toad, mountain chorus frog, green frog, pickerel frog, and wood frog. An endemic caddisfly lives on dripping cliffs at several locations in this Section.

The ichthyofauna in this Section is fairly common throughout the State, with the exceptions of the eastern sand darter, spotted darter, tippecanoe darter, and the redbreast dace. The area for the entire State within which the dace occurs abundantly lies only within a small range of this Section. Only a few small populations are found in bordering States. The paddlefish and sturgeon, which were once fairly common in these larger waters, have been impeded from most of their migration waters by impoundments and locks. These fish are by no means the only ones affected, but are good examples of the migration problems. Noticeable mussel fauna in this Section includes elktoe, snuffbox, long-solid, sheepnose, rabbitsfoot, and salamander mussel. Habitat and populations are being hindered by impoundments.

Climate. Precipitation averages 46 in (1,170 mm). About 20 in (500 mm) occur as snow. Temperature averages 55 °F (13 °C). The growing season lasts 175 days.

Surface Water Characteristics. There is a moderate to high density of small and medium perennial streams and associated rivers, most with moderate rates of flow and velocity. A dendritic drainage pattern has developed, with some influence from the underlying bedrock. One of the largest rivers is the Sequatchie.

Disturbance Regimes. Fire has probably been the principal historical source of disturbance, previously burning over moderately sized areas between natural barriers with moderate frequency and low intensity. Climatic influences include occasional summer droughts, winter ice storms, and tornadoes.

Land Use. Forests have been cleared for agriculture on about 20 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Section 221I—Southern Cumberland Mountains

Geomorphology. This Section is in the Appalachian Plateaus geomorphic province and originated when the Cumberland overthrust block was pushed westward as a result of thin-skinned tectonics. Prominent strike ridges are apparent along the thrust plate. Differential rates of erosion have contributed to the strongly dissected landscape. Landforms consist of low mountains and open hills. Elevation ranges from 1,200 to 3,000 ft (360 to 900 m). Local relief ranges from 100 to 300 ft (30 to 90 m).

Lithology and Stratigraphy. Rocks formed during the early Paleozoic Era. Strata consist of Pennsylvanian shales, siltstones, sandstones, and coal, and are level-bedded in much of the Section. However, strata along Pine Mountain are inclined 10° to 35°.

Soil Taxa. Soils are mostly Udults, with a small amount of Ochrepts. Hapludults and Fragiudults are on ridges and side slopes. Dystrochrepts are found on colluvium and Fluvaquents are on flood plains. These soils have a mesic temperature regime, an udic moisture regime, and mixed or siliceous mineralogy. Soils are mostly fine to medium textured, relatively deep, and have an adequate moisture supply during the growing season.

Potential Natural Vegetation. Küchler classifies vegetation as Appalachian oak forest and mixed mesophytic forest. The predominant vegetation form is cold-deciduous broad-leaved forest with evergreen needle-leaved trees. The oak-hickory forest cover type dominates this Section. The oaks on drier sites include post, southern red, scarlet, chestnut, and blackjack; on moister sites, white, southern red, and black oaks predominate. Shortleaf pine is usually present. Hickories, including pignut, mockernut, shagbark, and bitternut, form a common but minor component.

Fauna. The primary game animals and furbearers of the region are the white-tailed deer, gray fox, bobcat, raccoon, and gray squirrel. Black bears are present in low numbers in some areas. Some characteristic small mammals of forested habitats include the smoky shrew, short-tailed shrew, white-footed mouse, pine vole, and woodland jumping mouse. Rock talus habitats and high elevation wood lands also support masked shrews, rock shrews, cloudland deer mice, and the endemic Cumberland red-backed vole. The sandstone cliff lines and associated rock shelters are used by the eastern spotted skunk, Allegheny woodrat, northern long-eared bat, and eastern small-footed bat. The wild turkey and ruffed grouse are the two principal game birds of the Section; some characteristic songbirds include the solitary vireo, chestnut-sided warbler, black-throated green warbler, cerulean warbler, black and white warbler, American redstart, worm-eating warbler, ovenbird, and hooded warbler. Swainson's warbler is occasional in dense rhododendron thickets. The reptile fauna features the timber rattlesnake, northern redbellied snake, northern ringneck snake, eastern garter

snake, black rat snake, five-lined skink, and eastern box turtle. Common amphibian species are the Kentucky spring salamander, Black Mountain salamander, seal salamander, mountain dusky salamander, Cumberland Plateau salamander, spotted salamander, mountain chorus frog, pickerel frog, and wood frog. Several rare species of land snails to the glassy grapeskin, cupped vertigo, and the endemic Pine Mountain disc to occur in this Section.

The blackside dace, eastern sand darter, arrow darter, and the flame chub are the notable ichthyofauna in this Section. Many of the other fish fauna in this Section are typical of the entire state. The mining industry has had a significant impact on this Section and effectively inhibits habitat and populations. Many mussel fauna occur in this Section, however, none have been Federally listed. The Cumberland elktoe also occurs. A few are State sensitive but their range is unknown, as a large part of this Section has not been adequately inventoried. Mining and impoundments have affected and continue to affect habitat and populations.

Climate. Precipitation averages 46 in (1,170 mm); snow averages 20 in (500 mm) annually. Temperature averages 55 °F (13°C). The growing season lasts about 175 days.

Surface Water Characteristics. There is a moderate density of small to medium intermittent and perennial streams and associated rivers, most with moderate rates of flow. A dendritic drainage pattern has developed on a strongly dissected plateau. Tributaries of the Cumberland River drain this Section.

Disturbance Regimes. Fire has probably been the principal historical source of disturbance, previously burning over moderate-size areas between natural barriers with moderate frequency and low intensity. Climatic influences include occasional summer droughts and ice storms.

Land Use. Natural vegetation has been cleared for agriculture on about 20 percent of the Section. Coal mining is extensive in some areas.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Section 221J—Central Ridge and Valley

Geomorphology. This Section is in the Ridge and Valley geomorphic province. The Section consists of a folded, faulted, and uplifted belt of parallel valleys and ridges, strongly dissected by differential erosion, mass wasting, fluvial transport, and deposition. Landforms on most of the Section consists of open hills. Elevation ranges from 650 to 2,000 ft (200 to 600 m). Local relief ranges from 300 to 700 ft (90 to 210 m).

Lithology and Stratigraphy. Rocks formed during the early Paleozoic Era. Strata consist of approximately equal amounts of Cambrian (carbonates, conglomerates, and shales) and Ordovician (limestone, shales, and sandstone) marine sediments.



Low parallel ridges and valleys typical of the Central Ridge and Valley Section.

Soil Taxa. Soils are mostly Udults, with a small amount of Ochrepts. Paleudults are on areas underlain by sandstone. Valleys underlain by acid shale are dominated by Hapludults. Dystrochrepts and Eutrochrepts are on colluvium and bottomlands, respectively. These soils have a udic moisture regime and a thermic or mesic temperature regime. Soil depths range from shallow on sandstone ridges, to deep in limestone valleys. Most soils are well drained and have adequate moisture during the growing season.

Potential Natural Vegetation. Küchler classifies vegetation as Appalachian oak forest. The predominant vegetation form is cold-deciduous broad-leaved forest with evergreen needle-leaved trees. The oak-pine forest cover type dominates. The oaks on drier sites include post, southern red, scarlet, chestnut, and blackjack; on moister sites, white, southern red, and black oaks predominate. Shortleaf pine usually forms a major part of the canopy. Hickories, including pignut, mockernut, shagbark, and bitternut, form a common but minor component throughout. The loblolly pine-shortleaf pine cover type is prevalent in the southern part of the Section. In these stands canopy hardwoods on well-drained soils include sweetgum, blackgum, southern red oak, post oak, white oak, mockernut hickory, and pignut hickory.

Fauna. Among the fauna in this Section are white-tailed deer, black bear, bobcat, gray fox, raccoon, gray squirrel, fox squirrel, eastern chipmunk, white-footed mouse, pine vole, short-tailed shrew, and cotton mouse. The turkey, ruffed grouse, bobwhite, and mourning dove are game birds in various parts of this Section. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler,

and Carolina wren. The herpetofauna include the box turtle, common garter snake and timber rattlesnake.

Climate. Average annual precipitation ranges from 36 to 55 in (920 to 1,400 mm). Temperature ranges from 55 to 61 °F (13 to 16 °C). The growing season averages 170 to 210 days.

Surface Water Characteristics. This Section has a high density of small to medium perennial streams and associated rivers, most with moderate to high rates of flow. Trellis-type drainage pattern has developed, largely as a result of bedrock structural control. Most water originates from the adjacent Blue Ridge Mountains and Southern Cumberland Mountains Sections. The largest rivers are the Tennessee and Clinch.

Disturbance Regimes. Fire has probably been the principal historical source of disturbance, previously burning over small areas between natural barriers with moderate frequency and low intensity. Climatic influences include occasional droughts and ice storms. During the early 1900's, all American chestnut trees were killed by an introduced pathogen; sprouting still occurs from root systems.

Land Use. Natural vegetation has been cleared for agriculture and pasture on over 60 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southeastern Forest Experiment Station and Southern Region.

Province 222–Eastern Broadleaf Forest (Continental)

Thirteen Sections have been delineated in this Province: 222A–Ozark Highlands; 222C–Upper Gulf Coastal Plain; 222D–Interior Low Plateau, Shawnee Hills; 222E–Interior Low Plateau, Highland Rim; 222F–Interior Low Plateau, Bluegrass; 222G–Central Till Plains, Oak-Hickory; 222H–Central Till Plains, Beech-Maple; 222I–Erie and Ontario Lake Plain; 222J–South Central Great Lakes; 222K–Southwestern Great Lakes Morainal; 222L–North-Central U.S. Driftless and Escarpment; 222M–Minnesota and Northeastern Iowa Morainal; and 222N–Lake Agassiz, Aspen Parklands. These Sections are located in the central conterminous States, including parts of Arkansas, Missouri, Tennessee, Kentucky, Illinois, Indiana, Ohio, New York, Michigan, Wisconsin, Iowa, and Minnesota. The area of these Sections is about 270,000 mi² (699,300 km²).

Section 222A–Ozark Highlands

Geomorphology. This Section is part of the Ozark Plateaus geomorphic province. It is a maturely dissected high plateau with dendritic and radial drainage patterns. Most of the Section is equally divided between steep hills with local relief up to 1,000 ft (300 m) and rolling hills with local relief between 200 and 500 ft (60 to 150 m). There are also gently rolling plains with local relief of less than 200 ft; also present is the flat, 6-mile (10-km) wide Mississippi River flood plain, composed of broad bottom lands with associated terraces, ox-bows, and meander scars. Current geomorphic processes are fluvial erosion, transport and deposition, and mass wasting. Widespread karst features include caves, sinkholes, and springs. Elevation ranges from 300 to 1,800 ft (100 to 600 m).



The Ozark Highlands Section is an extensively forested region with steep, rocky hills and deep, narrow valleys.

Lithology and Stratigraphy. Quaternary loess deposits (unconsolidated aeolian silt) are widespread on the uplands; areas without loess cover have moderately thick residuum. Lower slopes are covered with Quaternary colluvium; valley bottoms are characterized by alluvial material. The Mississippi's flood plain has up to 150 ft (45 m) of unconsolidated Tertiary and Quaternary alluvium (gravel, sand, silt, and clay) overlying bedrock. Bedrock consists of lower Ordovician dolomite and sandstone, with lesser amounts of Silurian, Devonian, Mississippian, and Pennsylvanian rocks (limestone, chert, sandstone, and shale) around the Section's margins. The oldest bedrock units, near the center of the Section and forming the highest hills, are Proterozoic igneous rocks, volcanics ranging from rhyolite to andesite, some gabbro, and a large granitic pluton.

Soil Taxa. There are Udalfs and Udufts, with mesic temperature regime and udic moisture regime. The soils are mostly cherty, developed in loess mantle. Mineralogy is siliceous or mixed. Soils are generally old, shallow, stony, and acidic, except on broad ridges and bottomlands.

Potential Natural Vegetation. Kùchler vegetation types are mapped as oak-hickory forest, oak-hickory-pine forest, mosaic of bluestem prairie and oak-hickory forest, and cedar glades. Dry upland sites include post oak-blackjack, oak-black hickory, with lichen-moss ground cover, and shortleaf pine-oak in areas of sandstone bedrock. Mesic slopes sites have white oak-northern red oak-bitternut hickory-flowering dogwood. Riparian sites have river birch-silver maple. Glades have little bluestem-baldgrass; eastern redcedar has invaded these prairie sites as a result of fire suppression. The current trend is to characterize Ozark's landscapes as "wood land" or "savanna" rather than "forest," in recognition of the role of frequent, low-intensity fire.

Fauna. Major ungulates are white-tailed deer and cattle (elk, and bison were extirpated). The major predator is the coyote (the red wolf, timber wolf, and cougar were extirpated). The mink, otter, beaver, black bear, fox, and bobcat had declined but are recovering. The Section supports opossum and some threatened and endangered bats; armadillo recently began invading. Bird species total 143, including bald eagle and other raptors, turkey, various owls, wood duck, roadrunner, kingfisher, various woodpeckers, and various songbirds (many warblers). Habitat diversity (glades, sinkholes, and caves) contributes to rich herpetofauna, including rattlesnakes, copperheads, turtles, and many salamanders. The richness of fish species is great, including 18 endemics and some relics. Introduced trout and carp are thriving. Crustaceans (19 endemic crayfish) and molluscs (seven endemics) include some threatened and endangered species. Insects, spiders, and ticks are very abundant; the gypsy moth not been established as of June 1994.

Climate. Mean annual precipitation is 40 to 48 in (1,020 to 1,220 mm) from northwest to southeast. Snow averages about 10 in (240 mm). Mean annual precipitation is 55 to 60 °F (13 to 16 °C). The growing season lasts 180 to 200 days. Frost pockets are common.

Surface Water Characteristics. Clear, cold spring-fed streams characterize the Ozarks. Karst topography influences surface water, producing losing streams, springs (some large) and spring-fed streams, seeps, and fens. Small sinkhole ponds exists but few natural lakes; however, several large rivers have been dammed to create reservoirs. There is a moderate density of small intermittent drainages, and small to medium-sized perennial streams, most with low to moderate rates of flow.

Disturbance Regimes. Frequent, low intensity, widespread fire occurred prior to European settlement. Fire suppression led to changes in community type and species composition. Closed-canopy forests replaced many wood lands; pastures replaced prairies, glades, and bottom land forests. Climatic influences include occasional summer droughts, winter ice storms, and tornadoes.

Land Use. Forestry, tourism, hunting and fishing, grazing, and lead mining dominate.

Cultural Ecology. Fourteen thousand years ago, small, highly mobile groups of people followed now-extinct Pleistocene game animals such as mammoth and mastodon into the region. The land region was covered by late-glacial forests of oak, ash, jack pine, and spruce. Ten thousand years ago the climate became warmer and drier, and prairie, oak savannas, and oak-hickory and pine forests dominated. An abundance of resources supported increasingly larger, denser human populations. One thousand years ago intensive horticultural practices began. Three hundred years ago, the Osage continued seasonal exploitation of Ozark's resources. Two hundred and fifty years ago French explorers arrived and soon began lead, iron and barite mining activities. Until the mid-1800's the region remained an agricultural frontier, populated principally by yeoman farmers who supplemented their diet with wild resources. Intensive harvesting of pine and oak forests occurred between 1850 and 1915. Economic and cultural prosperity peaked around 1910; but poor timber harvesting and farming practices, in combination with frequent fires and floods, left the land bare. In 1933 land management activities emphasizing resource protection and rehabilitation were started. At the same time, provisions were made for recreation developments since hundreds of thousands of people were within a day's drive of public lands.

Compiled by Eastern Region and Missouri Department of Conservation.

Section 222C—Upper Gulf Coastal Plain

Geomorphology. This Section is in the Coastal Plains geomorphic province. The predominant landforms are irregular, shallow to moderately dissected plains of alluvial origin formed by deposition of continental sediments onto a submerged, shallow continental shelf, which was later exposed by sea level subsidence. Geomorphic processes currently active include gentle-gradient valley stream erosion, transport and deposition. Elevation ranges from 80 to 330 ft (25 to 100 m). Local relief seldom exceeds 100 ft (30 m).

Lithology and Stratigraphy. Unconsolidated sediments in this Section formed during the Mesozoic (15 percent) and Cenozoic (85 percent) Eras. Mesozoic strata consist of Cretaceous marine sediments (sandstone, and limestone). Cenozoic strata consists of Tertiary marine sediments.

Soil Taxa. Soils are mostly Udalfs. Uplands are dominated by well drained Hapludalfs. Fragiudalfs occur on moderately well drained side slopes and terraces. Paleudalfs, Fragiudalfs and Hapludults have formed where the mantle of loess is thin. Dystrochrepts, Udifluvents, and Fluvaquents are present on flood plains. These soils have a thermic temperature regime, an udic moisture regime, and mixed mineralogy. Soils are generally deep, medium textured, and have adequate moisture supply for use by vegetation during the growing season.

Potential Natural Vegetation. Küchler classifies vegetation as oak-hickory forest, blackbelt, and a mosaic of bluestem prairie and oak-hickory forest. The predominant vegetation form is temperate lowland and submontane broad-leaved cold-deciduous forest and cold-deciduous alluvial forest. The oak-hickory forest cover type dominates this Section. The oaks on drier sites include post, southern red, scarlet, chestnut and blackjack; on moister, sites white, southern red, and black oaks predominate. Shortleaf pine is usually present. Hickories, including pignut, mockernut, shagbark, and bitternut, form a common, but minor component. Bottom land hardwoods occupy recent alluvium along major rivers. Many young stands are dominated by eastern cottonwood and black willow. Older stands include a mixture of species, including hackberry, sugarberry, American elm, boxelder, overcup oak, water hickory, and green ash.

Fauna. Among the fauna in this Section are white-tailed deer, black bear, bobcat, gray fox, raccoon, gray squirrel, fox squirrel, eastern chipmunk, white-footed mouse, pine vole, short-tailed shrew, and cotton mouse. The turkey, ruffed grouse, bobwhite, and mourning dove are game birds in various parts of this Section. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake, and timber rattlesnake. Endemics to this Section include Sequoyah

slimy salamander, Kiamichi slimy salamander, goldstripe darter, and blackspot shiner. Threatened and endangered species are bald eagle, American alligator, and American burying beetle. Species extirpated or extinct are red wolf, ivory-billed woodpecker, Bachman's warbler, passenger pigeon, and the Carolina parakeet.

Climate. Average annual precipitation averages 48 to 52 in (1,200 to 1,320 mm). Average temperature ranges from 61 to 68°F (16 to 20 °C). The growing season lasts 200 to 280 days.

Surface Water Characteristics. There is a moderate density of small to medium perennial streams and associated rivers, most with moderate volume of water at low velocity. A dendritic drainage pattern has developed on this moderately dissected plateau. The largest rivers are the Obion and Hatchie.

Disturbance Regimes. Fire has probably been the principal historical disturbance. Climatic influences include winter ice storms and periodic flooding along major rivers.

Land Use. Natural vegetation has been cleared for agriculture on much of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Section 222D—Interior Low Plateau, Shawnee Hills

Geomorphology. This Section is part of the Interior Low Plateaus geomorphic province. Extensive sandstone bluffs, cuerdas, rise up to 100 ft (30 m) above the terrain in front of them and dip gently down the back slope. Other landforms include steep-sided ridges and hills, gentler hills and broader valleys, karst terrain, gently rolling lowland plains, and bottom lands along major rivers, with associated terraces and meander scars. A notable but very minor landform is anthropogenic. lands that have been strip-mined exhibit hummocky or ridge-swale topography. Current geomorphic processes are fluvial erosion, transport and deposition; mass-wasting; and karst solution. Elevation ranges from 325 to 1,060 ft (100 to 325 m). Lowest elevations occur along the Ohio River, the highest at Williams Hill in Illinois.

Lithology and Stratigraphy. Bedrock under about 50 percent of this Section consists primarily of flat-lying Pennsylvanian sandstones (bluff formers), with minor amounts of siltstone, shale, and coal. Interbedded Mississippian limestones, shales, and sandstones are bedrock in most of the remainder of the Section. In the Illinois portion of the Section, at its southern margin, thick, relatively homogeneous Mississippian



View southwest across Garden of the Gods Wilderness, Shawnee National Forest, Illinois. Sandstone bluffs dominate the foreground with a typical blackjack oak-post oak-cedar-farkleberry glade community.

limestones form the bedrock. At the geographic center of the Section, bracketing the Ohio River in Illinois and Kentucky, the flat-lying attitude of the bedrock has been radically altered or displaced by intense faulting, which has affected local topography.

Soil Taxa. These soils formed under deciduous forests from loess, residuum, and alluvium. The Section is dominated by Ultisol and Alfisol soil orders. However, recent investigations indicate inclusions of the Inceptisol order. Soils are generally well drained to moderately well drained; the drainage for a few soils varies in degree but is generally poor. They have a mesic temperature regime, and predominantly a udic moisture regime.

Potential Natural Vegetation. Küchler vegetational types include oak-hickory forest in the uplands of Illinois and Kentucky, and joined by maple-beech-birch in Indiana; oak-gum-cypress forest occupies the bottom lands throughout the Section. Uplands are dominated by the white oak, black oak, shagbark hickory community; the black jack oak, scarlet oak, pignut hickory community occupies drier sites; the beech, tuliptree, bitternut hickory, sugar maple, white ash community occupies deep, mesic ravines. The southern flood plains along the Ohio and Wabash rivers are dominated by the sycamore, Kentucky cofftree, sugarberry, and honey locust community, with local tupelo and cypress swamp communities.

Fauna. Eastern gray squirrel and white-tailed deer are common. In the early 1700's, bison roamed the wood lands. The marsh rice rat, cotton mouse, golden mouse, and Rafinesque's big-eared bat seem to be restricted to this Section. Canada geese and other waterfowl winter in large concentrations in the broader valleys and flat low lands of the region. Wintering populations of Ring-billed gulls are unique. Forest-interior birds such as the Cerulean warbler and the wood thrush live in the forested uplands, while the Swainson's warbler nests in the bottom land forests. The central newt, zigzag salamander, eastern mud turtle, and worm snake are prevalent present-day herptofauna. The clear rocky creeks are habitat for the least brook lamprey, black spottedtop minnow, and the spottail darter.

Climate. The mean annual precipitation is 45 in (1,140 mm) in Illinois and 44 in (1,120 mm) in Kentucky and Indiana. The average annual temperature ranges from 57 °F (14 °C) in Illinois to 55 °F (13 °C) in Kentucky and southern Indiana. Frost free days average about 190 in Illinois and 185 in Indiana.

Surface Water Characteristics. There is a moderate density of medium to large perennial streams and associated rivers, most with moderate volume of water at low velocity. Dendritic drainage has developed on a maturely dissected plateau, essentially without bedrock structural control, except where intense faulting occurs. There are few natural lakes except along the Ohio River, where oxbow lakes occur in flood plains. Uplands have

some clear, rocky streams and creeks. Streambank and channel erosion and mass wasting can be observed along segments of some streams.

Disturbance Regimes. The natural communities in this Section were influenced by large herbivores such as elk, by insects and tree diseases, by windstorms, and by drought and fire. Drastic environmental influences on the generally forested hills discouraged trees and maintained openings, glades, on slopes; extensive, bushy grasslands, called barrens, occur on some of the drier sites. Large herbivores, drought, windstorms, insects, and tree diseases kept the forest canopy open and similar to a savanna on ridges. Occasional wildfires helped to maintain the hill-prairies, glades, and barrens. Most communities were affected by mass wasting, due to shale bedrock outcrops, thin soils, and frequent freeze-thaw conditions. Beaver affected timber in narrow flood plains. Anthropogenic disturbances dominate today (see below).

Land Use. Prehistoric Native American activities had little effect on the Section. After 1800, approximately 50 percent of the landscape was cleared and most wetlands drained by Euro-Americans for farming. Fires became more frequent during this period, as did erosion, as the hillslopes were denuded for timber and fuel. The landscape is now a patchwork of forest and agricultural lands, the former used for recreation, ecosystem maintenance, and wood-fiber production, the latter for grazing and row crops. Energy and mineral production have affected and continue to affect small portions of the landscape; coal, iron, lead, zinc, fluorite, limestone, sand, and gravel have been mined in the Section, beginning in the mid-1800's. Oil and gas production began in the early 1900's.

Cultural Ecology. The earliest inhabitants of the Section (around 10,000 to 8,000 B.C.) were restricted to the higher elevations surrounding the remnants of the glacial lakes. Later prehistoric populations roamed across the Shawnee Hills, seasonally collecting plant foods such as nuts, seeds, fresh greens, and tubers, exploiting a rich faunal resource, and utilizing local minerals (ochre, clay, salt, chert, and fluorite). Due to agricultural innovations, latest prehistoric populations (900 to 1400 A.D.) largely inhabited the bottom lands of the Mississippi and Ohio Rivers (Sections 222C and 234A), although they continued to exploit the mineral, floral, and faunal resources of the interior hill region (Section 222D). Earliest Euro-American settlements (about 1700-1830) were generally located along the major transportation routes, including both overland trails and river corridors. Later settlers were attracted by the wooded hills of southern Illinois. The area was visually very similar to the lands they were migrating from, uplands of the southeastern United States. Their technology relied heavily on wood. forested areas were necessary for housing, tools, food, fodder, and fuel, both for personal use and to supply charcoal to local iron works. This and their diversified agricultural methods created eroded hillsides characteristic of the early

20th century Shawnee Hills. As the population increased and the amount of arable land decreased, the ridgetops and hillsides were increasingly cleared for agriculture. This continued until the land was so depleted it was not possible to produce a viable crop.

Compiled by Eastern Region and The Nature Conservancy.

Section 222E—Interior Low Plateau, Highland Rim

Geomorphology. This Section is characterized by platform deposition of continental sediments into a shallow inland sea, followed by uplifting to form a level-bedded plateau, which has been shaped by differential erosion to form a moderate to deeply dissected surface. Landforms on about 70 percent of the Section consist of about equal areas of open hills and irregular plains. About 20 percent consists of tablelands. This Section is in the Interior Low Plateau geomorphic province. Elevation ranges from 650 to 990 ft (200 to 300 m). Local relief ranges from 100 to 300 ft (30 to 100 m) on irregular plains and from 300 to 600 ft (100 to 200 m) on tablelands.

Lithology and Stratigraphy. Rock units formed during the Paleozoic Era. Strata consist of 10 percent Ordovician marine sediments (limestones), 10 percent Silurian marine sediments (limestone and shale), 10 percent Devonian marine sediments (sandstones and shale), and 60 percent Mississippian marine sediments (sandstone, limestone, and shale). The remaining 10 percent of strata are early to mid Paleozoic Era in age.

Soil Taxa. Soils south of the Kentucky and Tennessee border are mainly Udults that have a thermic temperature regime. In Kentucky and Indiana, Udalfs and Udufls are dominant and have a mesic temperature regime. Moisture regimes are udic and mineralogy is siliceous and kaolinitic. In the southern part, Paleudults are on hillsides and Fragiudults are on upland flats. Fragiaquults and Dystrochrepts are present in lower areas. In the northern area, Paleudults, Paleudalfs, Fragiudults, and Fragiudalfs are on upland areas. Hapludolls and Eutrochrepts are on bottom lands. The soils are deep, have a subsoil high in clay content, and have an adequate supply of moisture for use by vegetation during the growing season.

The Nashville Basin is a distinct, 6,000 mi² (15,600 km²) area in central Tennessee. Landforms around the outer edge of the basin are deeply dissected and toward the center are undulating. Soils, which consist mostly of Udalfs and Udults, are similar to those in other parts of the Section. A small area consists of Rendolls, which are dominated by redcedar forest or redcedar-deciduous brush communities.

Potential Natural Vegetation. Küchler classifies vegetation as oak-hickory forest, cedar glades, and a mosaic of bluestem prairie and oak-hickory forest. The predominant vegetation form is temperate low land and submontane broad-leaved cold-deciduous forest. The oak-hickory forest cover type dominates this Section. The oaks on drier sites include post, southern red, scarlet, chestnut, and blackjack; on moister sites, white and black oaks predominate. Shortleaf pine is usually present. Hickories, including pignut, mockernut, shagbark, and bitternut, form a common but minor component.

Fauna. Among the fauna in this Section are white-tailed deer, black bear, bobcat, gray fox, raccoon, gray squirrel, fox squirrel, eastern chipmunk, white-footed mouse, pine vole, short-tailed shrew, and cotton mouse. The turkey, ruffed grouse, bobwhite, and mourning dove are game birds in various parts of this Section. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake, and timber rattlesnake. Endemics to this Section include Sequoyah slimy salamander, Kiamichi slimy salamander, goldstripe darter, and blackspot shiner. Threatened and endangered species are bald eagle, American alligator, and American burying beetle. Species extirpated or extinct from this Section are red wolf, ivory-billed woodpecker, Bachman's warbler, passenger pigeon, and the Carolina parakeet.

Climate. Annual precipitation averages 44 to 54 in (1,120 to 1,370 mm). Temperature averages 55 to 61 °F (13 to 16 °C). The growing season lasts 180 to 205 days.

Surface Water Characteristics. This Section has a moderate density of small to medium intermittent and perennial streams and associated rivers, most with moderate volume of water at low velocity. A dendritic drainage pattern has developed on a deeply dissected plateau, with some influence from the underlying bedrock. The largest rivers include the Cumberland and Tennessee.

Disturbance Regimes. Fire has probably been the principal historical disturbance, previously burning over moderate-size areas between natural barriers with low frequency and low intensity.

Land Use. Natural vegetation from much of the area has been cleared for agriculture.

Cultural Ecology. Reserved.

Compiled by Southeastern Forest Experiment Station and Southern Region.

Section 222F—Interior Low Plateau, Bluegrass

Geomorphology. Platform deposition of continental sediments into a shallow inland sea was followed by uplifting to form a level-bedded plateau, which has been shaped by differential erosion to form a moderately to deeply dissected surface. Landforms on about 90 percent of the Section consist of about equal amounts of irregular plains and open hills. A small area consists of smooth plains. This Section is in the Interior Low Plateaus geomorphic province. Elevation ranges from 650 to 1,000 ft (200 to 300 m). Local relief ranges from 100 to 500 ft (30 to 150 m) in the open hills. In the smooth plains, relief is 100 to 300 ft (30 to 100 m).

Lithology and Stratigraphy. Rock units formed during the Paleozoic Era. Strata consist of 70 percent Ordovician marine deposits (limestone, shale, and sandstone); 10 percent Silurian marine deposits (limestone, and shale); and 20 percent Devonian marine deposits (sandstone, and shale).

Soil Taxa. Soils are mainly Udalfs. Hapludalfs, Paleudalfs, Fragiudalfs, and Hapludolls are typical on uplands. Hapludolls, Eutrochrepts, Fluvaquents, Hapludalfs, and Fragiudalfs are on bottom lands and flood plains. These soils have a mesic temperature regime, udic moisture regime, and mixed mineralogy. These soils are fine textured and most are deep.

Potential Natural Vegetation. Küchler classified vegetation as oak-hickory forest. The predominant vegetation form is temperate low land and submontane broad-leaved cold-deciduous forest, while cold-deciduous alluvial forest occurs along the major rivers. Major species in the oak-hickory cover type includes white, black, and northern red oaks. Bitternut, pignut, or shagbark hickories may also be present. Cottonwood, green ash, willow, and American elm are common species along major river bottom lands.

Fauna. The primary game animals and furbearers of the region are the white-tailed deer, gray fox, red fox, raccoon, opossum, striped skunk, mink, muskrat, eastern cottontail, fox squirrel, and gray squirrel. Common small mammals of forested habitats include the short-tailed shrew, white-footed mouse, and pine vole. In more open areas, the least shrew, prairie deer mouse, prairie vole, meadow vole, and, occasionally, the meadow jumping mouse occur. The bobwhite and mourning dove are the principal game birds of the Section; some common and characteristic songbirds include the warbling vireo, loggerhead shrike, mockingbird, eastern kingbird, eastern meadowlark, red-winged blackbird, indigo bunting, dickcissel, and brown-headed cowbird. The reptile fauna is less varied here than in other Sections; the eastern garter snake, queen snake, black rat snake, black racer, eastern milk snake, red-eared slider, and common snapping turtle are frequently seen. Common amphibian species are the

cave salamander, ravine salamander, Jefferson salamander, streamside salamander (nearly endemic), Cope's gray tree frog, American toad, green frog, bullfrog, and pickerel frog.

The small mammal, amphibian, and reptile fauna of the Ordovician limestone portion of the Bluegrass Section is quite distinctive and differs greatly from that of the Devonian shale portion. Numerous species of otherwise common animals are nearly or completely absent from the limestone region: a few examples include the golden mouse; longtail, seal, northern dusky, four-toed, and northern red salamanders; wood and southern leopard frogs; upland and mountain chorus frogs; five-lined and ground skinks; black kingsnake, timber rattlesnake, and brown and northern redbelly snakes. The fauna of the Devonian shale portion closely resembles that of the adjacent Cumberland Plateau, and for that aspect would be better lumped with that Section.

The paddlefish and sturgeon have been greatly impeded from their migration in these waters by locks, dams, and impoundments along the Ohio River and its major tributaries. Other fauna in these waters are common throughout the State. Uniquely noticeable mussel fauna within this Section are the elktoe, snuffbox, rabbitsboot, and salamander mussels. Populations and habitat being hindered by impoundments.

Climate. Precipitation averages 44 in (1,120 mm); an average of 14 in (370 mm) of snow falls annually. Annual temperature averages 55 °F (13 °C). The growing season lasts 180 days.

Surface Water Characteristics. There is a moderate density of medium to large perennial streams and associated rivers, most with moderate volume of water at low velocity. A dendritic drainage pattern has developed, with some influence from the underlying bedrock. Major rivers include the Kentucky and Licking.

Disturbance Regimes. Fire has probably been the principal historical disturbance, previously burning over moderate-size areas between natural barriers with low frequency and low intensity. Climatic influences include occasional summer droughts and tornadoes.

Land Use. Native vegetation has been cleared for agriculture on much of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Section 222G—Central Till Plains, Oak-Hickory

Geomorphology. This Section forms part of the Central low lands geomorphic province. The northern half is characterized by relative flatness and shallow entrenchment of drainages due to thick till deposits (50 to 100 ft, 15 to 30 m) that mask the topographic expression of the bedrock. Till is thinner (6 to 50 ft, 2 to 15 m) in the southern half, allowing the topography to be controlled by the relief on the deeply eroded bedrock. The dominant geomorphic process operating in the Section are fluvial erosion, transport and deposition. A notable but very minor landform is anthropogenic. lands that have been strip-mined exhibit humocky or ridge-swale topography. Elevation ranges from 330 to 985 ft (100 to 300 m).

Lithology and Stratigraphy. The greatest part of this Section is covered by Pleistocene (Illinoisan) till, ranging from more than 100 ft (30 m) thick in the north to a feather-edge at the southern boundary. Pleistocene (Wisconsinan) loess blankets most uneroded surfaces. There are significant areas of Wisconsinan slackwater-lake deposits (stratified silt, clay, and muck) along major rivers and tributaries. Mississippian limestones and sandstones are exposed above the Mississippi River's flood plain. Erosional "windows" through the till-plains expose Pennsylvanian sandstones and shales.

Soil Taxa. The soils on uplands are light colored and strongly developed, with poor internal drainage. The soils, developed from thin loess and till, support forest and prairie vegetation. Fragipan and claypan layers are characteristic in the upland soils. Prairie soils with a high sodium content are locally called "akaline slicks." Alfisols and Mollisols are the dominant soil orders. They are deep and medium textured with a mesic temperature regime, and an aquic or udic moisture regime. Inceptisols are a minor soil order.

Potential Natural Vegetation. Küchler indicates that the uplands support oak-hickory forest. bottom lands along the Ohio and lower Wabash support oak-gum-cypress; elm-ash-cottonwood forest grows along the upper Wabash and its major Indiana tributaries. Historically, 40 percent of uplands in the Section were tall-grass prairie, not forest. The dominant forest community is post oak, black oak, shingle oak, mockernut hickory, and shagbark hickory. Forests on the drier southern and western slopes are of the white oak, shingle oak, and black oak community; the white oak, white ash, basswood, sugar maple, and slippery elm community dominates more mesic sites. The flat woods community is post oak, swamp white oak, blackjack oak, and pin oak. Forests in the broad flood plains are dominantly silver maple, willow, sycamore, and American elm nearest the rivers, with pin oak, white oak, hickory, ash, hackberry, and honeylocust on heavier soils farther from the river banks. Pin oak occasionally grows in pure stands.

Fauna. Large carnivores including the mountain lion and black bear were gone from this area by the mid 1800's. The thirteen-lined ground squirrel and Franklin's ground squirrel occur at the southern edge of their range. The least weasel and badger are found here. The Carolina chickadee and greater prairie chicken are found in this Section. The crawfish frog, two-lined skink, redback salamander, fence swift, eastern box turtle, and rough green snake are common herpetofauna. Several darters, including the eastern sand, the dusky, and harlequin, are unique to this Section. The common stoneroller, spotted bass, mosquitofish, and Johnny darter are characteristic of the perennial streams and rivers.

Climate. The mean annual precipitation ranges from 45 in (1,140 mm) in the south to 44 in (1,120 mm) in the north. The average temperature ranges from 57 °F (14 °C) in the south to 55 °F (13 °C) in the northern part of this Section. Frost free days average from 180 to 190.

Surface Water Characteristics. This Section has a moderate density of medium to large perennial streams, most with moderate volume of water at low velocity. Dendritic drainage pattern has developed on submaturely dissected plateau, largely without bedrock structural control. There are few natural lakes except oxbows along the Kaskaskia, Big Muddy, and Wabash river flood plains. The Kaskaskia River Basin overall use (aquatic life) rating is full support. The Big Muddy and Wabash River Basins overall use (aquatic life) rating is partial support to minor impairment. The aquatic habitats consist of rivers, creeks, and oxbows.

Disturbance Regimes. Fire, both natural and human-caused, has probably been the principal historical source of disturbance, burning over moderate-size areas between natural barriers with moderate frequency and low intensity. Besides fire, grazing ungulates, insects and tree diseases, windstorms, drought, and ice were the major disturbances during presettlement times. They generally discouraged woody vegetation and encouraged grasslands on the flatter upland divides between forested drainages, and opened the canopy in the ravines and on slopes. Beaver dams occasionally created temporary ponds large enough to kill large stands of timber in the ravines and bottom lands. Over a period of years these ponds became filled with silt and became shallow wooded swamps or, on some sites, wet sedge meadows. Land use since settlement has caused conversion from forest, prairie, and wetland to agriculture on at least 80 percent of the area.

Land Use. The dominant land use is agriculture. About 90 percent of the original native vegetative cover has been replaced by cultivated crops, meadows, towns, or roads. Either or both plowing and livestock grazing have eliminated natural prairies. Of the forested areas, the remnants are on the steepest slopes, poorest soils,

or in flood plains too low and wet for cultivation. Coal strip-mining has and continues to affect a portion of the landscape.

Cultural Ecology. Early prehistoric, nomadic Native American populations had access to very rich and diverse faunal and floral resources in the Section. The most recent prehistoric groups settled near the prairie-forest margin because that environment offered well-timbered tracts for wood, food, and forage, as well as easily cleared and tillable prairie soils. Likewise, the Euro-American settlers initially occupied areas known as "points" at the head of river and creek valleys where the timber adjoins the prairie. This arrangement also afforded access to both prairie and forested environments. During the early years of the 19th century Euro-American settlers began to drain, clear, and plow the prairies and wood lands for agriculture; underground coal mining began soon thereafter. Although the soils of this region are not as fertile as those that underlie Section 251D, they are much less erodable than the soils in Section 222D, so this region has been more productive and economically stable. Currently the Section is dominated by typical rural agricultural activities and by coal mining and oil production.

Compiled by Eastern Region and The Nature Conservancy, Illinois Chapter.

Section 222H—Central Till Plains, Beech-Maple

Geomorphology. This Section is part of the Central Lowlands geomorphic province. It is characterized by its flatness and by shallow entrenchment of its drainages. This is a level to gently rolling till-plain (glacial ground moraine), with broad bottom lands along the few major river valleys. The plain is overlain by a series of low ridges (glacial end moraines) generally trending west to east in an undulating pattern. Drainage is dendritic with only minor entrenchment. The dominant geomorphic process operating in the Section is fluvial erosion, transport and deposition. Elevation ranges from 650 to 1,000 ft (200 to 300 m). Local relief is mainly a few meters, but in places, hills rise as much as 80 ft (25 m).

Lithology and Stratigraphy. The greatest part of this Section is covered by Pleistocene (Wisconsinan) till, ranging from 50 to more than 200 ft (15 to more than 60 m) thick. This material comprises both the ground and end moraines. Some small areas of Wisconsinan slack-water lake deposits (stratified silt, clay, and muck) also occur. Pennsylvanian, Mississippian, Devonian, Silurian, and Ordovician sedimentary rocks form bedrock under the till, and are exposed (youngest to oldest, west to east) in major drainages where erosion has removed the unconsolidated cover.

Soil Taxa. Most of the soils are Udalfs and Aqualfs and have udic and aquic moisture regimes and a mixed or illitic mineralogy. They formed in calcareous loamy glacial till, which is mantled by loess in the southern part of the Section.

Potential Natural Vegetation. K  chler type is beech-maple forest over most of the Section, with a significant amount of oak-hickory forest mapped in the southeast portion, and a few patches mapped as mosaic of bluestem prairie and oak-hickory forest.

Fauna. Small mammals that characterize this Section include the Franklin’s ground squirrel, Rafinesque’s big-eared bat, cotton rats, cottontail rabbits, and shrews. Examples of larger mammals currently using this Section include the whitetail deer, coyote, and red and gray foxes. Historically, this Section was once characterized by woods and plains bison, elk, black bears, mountain lions, and wolves. These species were gone by the mid-1800’s. Section 222H has few characteristic amphibians and reptiles, although the smallmouth salamander and Kirtland’s water snake are as plentiful here as in any adjacent Sections. This Section is within the migratory route for many songbirds. The western portion of Section 222H is in the flyway for sandhill cranes and was likely the historic route for this species.

Climate. Precipitation average 35 to 40 in (900 to 1,030 mm). Half or more of this precipitation occurs during freeze-free periods. The low precipitation in winter is mostly snow. Annual temperature averages 50 to 55   F (10 to 13   C). The growing season lasts 155 to 180 days.

Surface Water Characteristics. A major water divide occurs in this Section, separating water flowing to the Gulf of St. Lawrence from water flowing to the Gulf of Mexico. Once abundant, but now occurring as remnants, some bog ponds and pothole lakes, plus springs lie along this divide. Low gradient streams and rivers are predominant, except along the glacial boundary where moderate and high gradient streams do occur. The bottoms of streams are composed of sand, gravel, bedrock, and boulders. There is moderate to high stream density.

Disturbance Regimes. Disturbance from fire is uncommon, scattered, and small. By far the largest disturbance effect is from land use. Climatic-influenced disturbances include winter ice storms, occasional tornadoes, and periodic flooding along major river flood plains.

Land Use. Most of the Section is under heavy developmental pressures from urban development and agriculture. Most forested tracts are now second growth wood lots, less than 250 acres in size.

Cultural Ecology. Twelve thousand years of human habitation is represented. Archaic occupants broadly adapted to the general landscape, with earlier interaction near valley edges. Woodland ceremonial sites of the

Hopewell tradition are the most dramatic prehistoric cultural expression, representing vast trade networks of various local and exotic natural resource materials. The epicenter of the Hopewell Interaction Sphere lies in the Scioto River Valley. With the exception of steep side slopes of stream valleys, the entire area was cultivated historically. Europeans reached the area around 1650 A.D. Settlement consisted of farming communities; later, extractive industries, such as coal, iron ore, clay, oil and gas, and sandstone gained importance. Most of the Section is currently under developmental pressures from both agriculture and urban expansion.

Compiled by Eastern Region.

Section 222I–Erie and Ontario Lake Plain

Geomorphology. This Section is part of the Central low lands geomorphic province. It is characterized by its flatness and by shallow entrenchment of its drainages. This is a combination of level to gently rolling till-plain (glacial ground moraine), and flat lake plain. There are a few areas with broad, low ridges (glacial end moraines) generally trending parallel to the lakes’ shorelines. The eastern end of the Section, in New York State, includes either or both moderately dissected till and drumlin plains on three low but notable “stairstep” escarpments, parallel to and below the northern margin of the Allegheny Plateau. Geomorphic processes operating in the Section include: fluvial erosion, transport and deposition; lakeshore erosion and deposition; and minor dune construction. Elevations range from 245 ft (75 m), which is the mean elevation of the surface of Lake Ontario, and extend up to 1,000 ft (300 m) along the Appalachian Plateau border. Most of the land is under 800 ft (240 m) in elevation. Local relief ranges between 0 to 300 ft (0 to 90 m). Gentle slopes cover 50 to 80 percent of the area, 50 to 75 percent occur on low lands.

Lithology and Stratigraphy. The moraines, covering about half this Section, are composed of Pleistocene (Wisconsinan) till. The rest, the Maumee basin and along the margins of Lakes Erie and Ontario, is composed of Wisconsinan lacustrine deposits (stratified clay, silt, marl, peat, and muck), with sand forming prehistoric beach ridges and dunes. These glacial deposits range from 50 to about 200 ft (15 to 60 m) thick. Ordovician, Silurian, and Devonian sedimentary rocks form bedrock under the till and lake deposits, and are exposed intermittently along the lakeshores.

Soil Taxa. Soils are predominantly Udalfs and Aqualfs. Ochrepts and Aquepts are more common near the shore of Lake Ontario. Udipsamments predominate around Lake Oneida and in the eastern Mohawk Valley. Notable areas of medisaprist soils occur in the central part of the Section in New York. Soil temperature regime is mesic; soil moisture regimes are dominantly udic and aquic.

Potential Natural Vegetation. Kùchler vegetation types include northern hardwood forest, beech-maple forest, and elm-ash forest. Other, regionally-defined important vegetation types include beech-maple mesic forest in the east, maple-basswood forest, hemlock-northern hardwood forest, oak openings, and pitch pine-heath barrens.

Fauna. Current mammal populations are typified by the masked shrew, cottontail rabbit, eastern chipmunk, woodchuck, southern flying squirrel, white-footed mouse, raccoon, long-tailed weasel, striped skunk, and white-tailed deer. Common birds in this Section today include the green-backed heron, mallard, American kestrel, American woodcock, mourning dove, downy woodpecker, eastern wood-peewee, red-eyed vireo, common yellowthroat, rose-breasted grosbeak, song sparrow, northern oriole. Some amphibians and reptiles which are characteristic of this Section include the American toad, leopard frog, snapping turtle, painted turtle, northern water snake, garter snake, and milk snake. Habitats in this Section have been greatly modified by modern man— wetlands drained, forests cleared, large urban areas developed. The bison, elk, black bear, mountain lion, timber wolf, and massasauga were all fairly common historically but have since been extirpated (except for the black bear and massasauga, which continue to occur in small numbers). The bobcat and porcupine, also common in the past, were extirpated from the west portion but still occur in the east. The white-tailed deer, bald eagle, and wood duck are three animals which have made respectable recoveries in the 20th century after being extirpated (or nearly so) in the past.



A relatively flat, agricultural landscape characteristic of the Erie and Ontario Lake Plain Section.



Classic drumlin with north-to-south orientation on a lake plain, Monroe County, New York.

This Section has a great diversity of aquatic habitats and fishes. Species like the lake sturgeon, lake trout, cisco, lake whitefish, blue pike, and Great Lakes muskellunge were once commercially important species in Lakes Erie and Ontario. The blue pike is considered extinct, and the other species have seen a dramatic decline in numbers. Unplanned introductions of species like the sea lamprey, and planned introductions of coho and chinook salmon, have created changes in the Erie and Ontario fisheries over time. The largemouth and smallmouth bass, walleye, yellow perch, northern pike, and emerald shiner are commonly found in the quiet shoreline areas of Erie and Ontario, and in the inland natural lakes. Warm water streams in this Section provide habitat for black bass, sunfish, walleye, mudminnows, and other species. Brown trout, brook trout, coho salmon, and chinook salmon can be found in the colder streams in this Section.

Climate. Precipitation averages 27 to 45 in (700 to 1,150 mm), increasing from west to east. Precipitation is distributed evenly throughout the year. Immediately adjacent to Lake Erie, snowfall averages 40 to 60 in (1,020 to 1,520 mm); in the remainder of the zone, it ranges from 60 to 80 in (1,520 to 2,030 mm). Mean annual temperature ranges from 45° to 52 °F (7° to 11 °C). The growing season lasts 140 to 160 days, but ranges to 180 days in a narrow belt along Lake Ontario.

Surface Water Characteristics. Abundant water resources include perennial streams, inland lakes, canals, reservoirs, and wetlands. Lake Erie, Lake Ontario, and the St. Lawrence River border this U.S. Section on the north. The Mohawk River and Blackhawk River are large streams of regional importance. Streams tend to be shallowly entrenched and have low gradients. Low gradient streams with deranged drainage patterns are common due to topography and glacial influence. Moderate gradient streams occur in the foothills and Mohawk Valley. Large lakes include the Finger Lakes. Seneca (67 mi², 174 km²), Cayuga (66 mi², 172 km²), Owasco (10 mi², 26 km²), Skaneateles (14 mi², 36 km²), and Canandaigua (17 mi², 44 km²) all of which were developed through glacial scouring; and Oneida Lake (80 mi², 208 km²). Average annual runoff ranges from 16 to 20 in (410 to 510 mm) and approaches 30 in (760 mm) adjacent to the Tug Hill Plateau.

Disturbance Regimes. Climatic-induced disturbances include winter ice storms and occasional tornadoes. Presettlement swamp forests, wet prairies, and marshes, were flooded during several months of the year. Natural disturbance regimes now affecting the streams and rivers are floods and droughts. Anthropogenic disturbance to aquatic systems includes channelization, ditching, and input of industrial waste, sewage, and soil. Insect and disease disturbances have resulted from Dutch elm disease, chestnut blight, and ash dieback among others. Occasional fire disturbances are small and scattered.

Land Use. The dominant land use in this area is agriculture, accounting for about 50 percent of total acreage in this Section. Forest land, mostly in farm woodlots, occupies 30 percent of the area. The remaining land is in residential and urban use.

Cultural Ecology. There have been 10,000 years of human occupation in this area, which was the historic home of the Miami, Erie, and Iroquois Tribal groups. Occupation was predominantly sedentary, with subsistence based on hunting, gathering, fishing, and later farming. Euro-American settlement began during the latter 18th to early 19th centuries, with the exploitation of a variety of natural resources and development of large population centers such as Detroit, Cleveland, and Buffalo. Today the area relies upon shipping, agriculture, and a variety of industrial economic activities.

Compiled by Northeastern Forest Experiment Station, Northeastern Area State and Private Forestry, and the Eastern Region.

Section 222J—South Central Great Lakes

Geomorphology. This Section is part of the Central low lands geomorphic province. It is a combination of a level to gently rolling low land (glacial ground moraine) and flat outwash or lacustrine plains. Dune fields are present along Lake Michigan. Cropping out of the plains are partially buried end moraine ridges and mounded ice-contact hills. Three glacial lobes converged in southern Michigan, and morainal ridges are arranged in roughly parallel arcs along the paths of glacial retreat. Glacial outwash plains and deltas are found along major drainages. Drainage is dendritic with pronounced terracing. Geomorphic processes operating in the Section include: fluvial erosion, transport, and deposition; lakeshore erosion and deposition; and minor dune construction. Elevation ranges from 580 to 1,280 ft (175 to 396 m), mostly below 1,000 ft (300 m). Local relief is primarily 6 to 200 ft (2 to 60 m).

Lithology and Stratigraphy. This Section is covered by Pleistocene (Wisconsinan) glacial drift, including till, lake sediments, and outwash, ranging up to about 1,300 ft (396 m) thick over bedrock. Extensive areas near Lake Huron are underlain by lacustrine deposits, mainly stratified clay and silt, overlain by sand prehistoric-beach ridges. Pleistocene and Holocene sand dunes lie along Lake Michigan. Devonian, Mississippian, Pennsylvanian, and Jurassic sedimentary rocks underlie the drift. Bedrock is exposed along Huron's shores and occasionally inland.

Soil Taxa. Udalfs, Aqualfs, Aquolls, Rendolls, and Udolls occur on loamy moraines and till plains. Fluvents are in flood plains. Psammets and Orthods are on outwash and ice-contact sands. Histosols are in low-lying areas; many are artificially drained. Moisture regime is mostly udic, with some aquic and xeric. Temperature regime is Mesic.

Potential Natural Vegetation. Küchler vegetation types are oak-hickory forest, dominating sandy sites and beech-maple forest on loamy soils.

Fauna. Historically, the caribou, elk, and moose were common large mammals in the Section, along with the wolf. These species have been extirpated, with the exception of a small population of wolves. Currently, whitetail deer are common, along with beaver, muskrat, raccoon, skunk, and coyote. Birds include hawks, eagles, peregrine falcons, sandhill cranes, ducks, quail, grouse, and songbirds. Gulls, terns, sandpipers, and cormorants are found near the Great Lakes. Anadromous fish, such as steelhead, brown trout, and chinook and coho salmon, run up rivers and streams from the Great Lakes. Resident fish are brook and rainbow trout; in lakes, there are walleye, northern pike, smallmouth and largemouth bass, and a variety of panfish. Endangered species include the bald eagle, wolf, Piping plover, Karner blue butterfly, American burying beetle, and Hungerford's crawling water beetle.

Climate. Precipitation averages 29 to 36 in (750 to 930 mm). Temperature averages 45 to 50 °F (7 to 10 °C). The growing season lasts mainly 140 to 160 days, but up to 180 days near Lake Michigan's shoreline.

Surface Water Characteristics. Low-gradient streams and rivers drain mostly into the Great Lakes, but those in the southern extremity of the Section drain into the Mississippi-Ohio Rivers drainage system. Lakes that are small to medium-size are present, but not abundant. Wetlands, many seasonally flooded, formed in extensive low-lying areas in former glacial lakebeds; many are now artificially drained.

Disturbance Regimes. Fire was the dominant natural disturbance in the oak-hickory forest. Tornadoes and windshear events, together with gaps in the overstory, were responsible for regenerating the beech-sugar maple forests.

Land Use. Much of the land was cleared and drained for agriculture during the 19th century. Current land use is predominantly for agriculture, secondarily for urban and industrial development, with only a minor amount remaining in forest vegetation. Gas and oil development occurs in some of the area.

Cultural Ecology. Native peoples utilized the area extensively for fishing, gathering, farming, and hunting. They used fire to manage vegetation, especially in the oak-hickory forest, often creating barrens. During this century, the Section has been dominantly occupied by industrial workers, many of whom moved from Appalachia and economically depressed southern states. In recent years, the economy has diversified and a cross-Section of service and professional workers now occupies the several large metropolitan areas of this Section. Agriculture, while a major land use, employs relatively

few people. Conflicts develop among residents who wish to preserve remnants of natural ecosystems, and those who advocate further development. There is very little publicly owned land.

Compiled by Eastern Region.

Section 222K—Southwestern Great Lakes Morainial

Geomorphology. This Section is part of the Central Lowland geomorphic province. It is characterized by flat to undulating topography resulting from glaciation: plains composed of till, outwash, and lacustrine; drumlin fields and morainal ridges; and local occurrences of other features (kames, eskers, kettles, etc.). Drainage is dendritic with only minor entrenchment. Geomorphic processes operating in the Section include: are fluvial erosion, transport and deposition; lakeshore erosion and deposition; and minor dune construction. Elevation ranges from about 570 to 1,650 ft (175 to 500 m). Local relief ranges from a few feet on plains to about 300 ft (90 m) in some places, such as interlobate moraines and a few bedrock escarpments.

Lithology and Stratigraphy. Section 222K is covered by Pleistocene (Wisconsinan) glacial drift. till, lacustrine sand-silt-clay-peat-muck, and either or both outwash sands and gravels, ranging in thickness up to about 400 ft (120 m). Bedrock beneath the drift is composed primarily of Ordovician and Silurian dolomite and minor sandstone; some Cambrian sandstone occurs in the northernmost part, and Mississippian shale underlies the southeastern corner. Bedrock is exposed intermittently, mostly in the northern and western portions of the Section where the drift is thinnest.

Soil Taxa. Mostly Alfisols predominates. A few large outwash plains in the northwestern part of the Section are dominated by sandy Entisols. Mollisols occur extensively in the Till Plains and dominant in the southeastern portion of the Section, and in some lacustrine plains. There is also a significant occurrence of Histosols, largely coincidental with bogs. Moisture regimes are mostly Udic, with occurrences of aquic and xeric regimes. Temperature regime is Mesic, except for the northwestern extremity, which is currently considered to be in the frigid zone.

Potential Natural Vegetation. Küchler vegetation types are primarily oak savanna, with a lesser extent of maple-basswood forest, and some small areas of bluestem prairie.

Fauna. Large mammals historically found in this Section were the bison and elk, which occurred in large numbers. The whitetail deer was common but apparently not numerous. The major predator was the wolf. Smaller mammals and birds were characterized by the prairie chicken (open areas), sharptail grouse, long-billed curlew, Franklin's ground squirrel, and many species adapted to a

mixture of prairie, oak savanna, and forested conditions. The passenger pigeon occurred in vast numbers, as did many species of both nesting and migrating waterfowl. Today the dominant large mammal is the whitetail deer, which has extended its range into this Section from the north in the past 25 years. The elk and wolf were extirpated by the early to mid-1800's. Dominant smaller animals today are the introduced ringneck pheasant, and the red fox, coyote, raccoon, and both red and gray squirrels. The wild turkey has recently been reintroduced and has rapidly expanded into all parts of this Section. Most waterfowl species are far less numerous today, except for Canada geese and the sandhill crane, which appear to be benefitting from waste grain in agricultural operations.

Common fish species today are the largemouth bass, perch, crappie, northern pike, and walleye. The Lake Michigan fishery has been substantially altered by the invasion of non-native species such as the alewife, zebra mussel, and spiny water flea. Coho and chinook salmon and steelhead trout have been introduced and have established runs up many streams draining into Lake Michigan.

Climate. Precipitation averages 29 to 35 in (750 to 900 mm). Two-thirds of this amount falls during the growing season. Winter precipitation is mostly snow. Temperature averages 43 to 52 °F (6 to 11 °C). The growing season lasts 125 to 160 days (180 days in a narrow band along Lake Michigan).

Surface Water Characteristics. This is a relatively young landscape with a relatively low to medium density of streams, which tend to be low gradient and slow flowing. Surface drainage networks are fairly well developed except in end moraines, interlobate moraines, and large outwash plains. There is a relatively high occurrence of lakes created by glacial action. Drainage is into the Upper Mississippi Basin, mostly via the Wisconsin, Rock, and Illinois River systems, and into Lake Michigan.

Disturbance Regimes. Fire was apparently important in maintaining the oak Savannas and prairies. Windthrow occurred in some localized areas.

Land Use. Most of the area is used for agriculture. There is a heavy concentration of urbanization along much of the Lake Michigan shoreline (including the cities of Chicago and Milwaukee); urban development is also dominant in the Lake Winnebago and Madison areas of Wisconsin. Outdoor recreation is an important category of land use, and is largely associated with the many inland lakes, as well as the Lake Michigan shoreline.

Cultural Ecology. Native American occupation and ecological exploitation began as early as 10,000 years ago. These early inhabitants evolved from mobile, nomadic hunting groups to more sedentary groups adapting to subsistence based on farming and hunting. Historically, the area encompasses the Illinois and Winnebago Tribal

Territory. European exploration occurred between 1620 and 1665. From 1665 to 1828, fur trade was predominant in the area. Large metropolitan cities such as Chicago and Milwaukee developed in the latter 19th and early 20th centuries and prospered as a result of natural resource exploitation and utilization. Today, a vast number of industries provide employment for the area's dense population.

Compiled by Eastern Region.

Section 222L—North-Central U.S. Driftless and Escarpment

Geomorphology. This Section is part of the Central low lands Geomorphic Province. It is bisected by the Mississippi River flood plain. The Section is a maturely dissected, upland plateau where broad, steep-sided bedrock ridges and "mounds" up to 500 ft (150 m) high are separated by wide, flat-bottomed drainages in the southern portion of the Section, and by narrow, V-shaped valleys farther north. Current geomorphic processes include: fluvial erosion, transport and deposition; masswasting; and karst solution. Elevation ranges from 650 to 1,300 ft (200 to 400 m). Local relief ranges from 100 to 600 ft (30 to 180 m).

Lithology and Stratigraphy. Much of the upland area is blanketed with Pleistocene loess, Kansan west of the Mississippi and Wisconsin to the east. Residuum and colluvium mantle most slopes, and alluvium occupies larger valleys. Beneath this unconsolidated material, bedrock consists of Cambrian sandstone and dolomite, Ordovician dolomite, shale and sandstone, and Silurian dolomite, with a local occurrence of Proterozoic quartzite. Small, isolated outliers of Cretaceous sandstone and shale overlie the Paleozoic rocks at the western edge. Ridges and "mounds" are capped with the resistant dolomites and quartzite. Broader drainages are underlain by Ordovician shale. Bedrock is heavily jointed, with much evidence of solution in the carbonates.

Soil Taxa. Dominant types are mostly Udalfs. Udolls occur on benches, some broad ridgetops, and steep slopes bordering major valleys. Fluvents and Psammments occur locally along streams on flood plains and stream terraces. Mesic temperature and udic moisture regimes dominate.

Potential Natural Vegetation. Küchler types are oak savanna and maple-basswood forest, with some northern flood plain forest along some of the major rivers.

Fauna. This Section was characterized by bison, antelope and prairie chicken on the open prairies, and elk and bison in the oak savannas and bottom land forests along major rivers. Whitetail deer and sharptail and ruffed grouse occupied the early and mid-successional vegetation stages common in this Section as a result of fire and wind. Large predators were the wolf and black bear. The passenger pigeon was common throughout all forested



A dissected landscape typifying the North Central U.S. Driftless and Escarpment Section.

sites, including the oak savanna. Waterfowl were largely restricted to the Mississippi River and adjacent riparian habitats, which hosted large migratory populations in the spring and fall. Today the elk, bison, and wolf have been extirpated, and the very abundant whitetail deer is the dominant large mammal. The sharptail grouse and prairie chicken have disappeared, but the ruffed grouse is common. The introduced ringneck pheasant is found in moderate numbers and the reintroduced wild turkey has rapidly expanded its range to all parts of the Section. Gray and red squirrels are common, along with the cottontail rabbit; but waterfowl populations are greatly reduced, with the exception of Canada geese and sandhill cranes. Great blue herons and cormorants are common along the Mississippi. Fish habitat consists mostly of large and small river systems which contain the northern pike, catfish, largemouth bass, walleye, carp and sucker.

Climate. Precipitation averages 29 to 35 in (740 to 890 mm). About 40 to 45 percent falls during the growing season. Average annual temperature is 45 to 50 °F (7 to 10 °C). The growing season lasts for 136 to 160 days.

Surface Water Characteristics. This is a maturely dissected landscape with a fairly high density of perennial and intermittent streams. The drainage pattern is mostly dendritic; however, many streams and valleys exhibit abrupt turns caused by joints in bedrock. Valleys are deeply incised. Natural lakes are rare or nonexistent. This Section is dissected by the Mississippi River.

Disturbance Regimes. Fire was historically important on the upland prairie and oak dominated ecosystems. Recent records of tornadoes and ice storms indicate that they locally impacted forest vegetation.

Land Use. The current dominant land use is agriculture; about 30 to 40 percent is in crop land. Most of the steeper side slopes remain wooded.

Cultural Ecology. There have been 10,000 years of human occupation in this part of the Upper Mississippi Valley cultural area. The Native American lifestyle was predominantly sedentary. The primary occupation was subsistence-based hunting; later farming gained importance. This area was home to the historic Illinois tribal group. Euro-American settlement began during the latter 18th to early 19th centuries, with exploitation of a variety of natural resources (forests and wildlife). Dairy farming became the major economic activity during the latter 19th and early 20th centuries.

Compiled by Eastern Region.

Section 222M—Minnesota and Northeastern Iowa Morainal

Geomorphology. This Section is part of the Central Lowland geomorphic province. It is characterized by level plains and low, irregular hills resulting from glaciation: till and outwash plains; drumlin fields and morainal ridges; and local occurrences of other features (e.g., kames, eskers, and kettles). Poor to unintegrated (chaotic) drainage is common in the northern portion of the Section; to the south, drainage is dendritic with only minor entrenchment. Geomorphic processes operating in the Section are fluvial erosion, transport and deposition. Elevation ranges from 1,000 to 1,600 ft (300 to 485 m). Local relief is generally less than 100 ft (30 m).

Lithology and Stratigraphy. This Section is covered by Pleistocene (Wisconsinan in the north half, Illinoian-Kansan in the south) glacial drift; till and outwash sands and gravels, ranging in thickness from 30 to 500 ft (9-150 m), thinning toward the south. A thin, discontinuous mantle of loess overlies a pre-Illinoian landscape in the southern part of the Section. Bedrock is composed of Archaean granite, greenstone, and metasediments in the northern half of the Section, with Cambrian sandstone, Ordovician shale, dolomite and sandstone, and Silurian dolomite in the southern half. Bedrock is exposed intermittently, mostly in the southern and eastern portions of the Section where the drift is thinnest.

Soil Taxa. Dominant types include Mollisols, Alfisols, and Entisols. Moisture regime is dominantly mesic; some areas are xeric and some are aquic. Temperature regime is dominantly mesic, but ranges to frigid in the northern extremity.

Potential Natural Vegetation. Küchler's map shows mostly bluestem prairie with significant maple-basswood forest and lesser amounts of oak savannah, oak-hickory forest, and northern flood plain forest. Other investigators indicate bluestem prairie may be a more minor component, with greater dominance of oak savannah and oak wood lands.

Fauna. This Section represents the meeting of the plains of the west and the wood lands of the upper midwest. It contained large and diverse populations of wildlife. Bison were common, and this may have been optimum North American habitat for the elk. The dominant large predator was the wolf. Prairie chicken, sharptail grouse, passenger pigeon, jack rabbit, coyote, and fox were common. The bison, elk, and wolf were extirpated, but the coyote and fox remain numerous. The prairie chicken and sharptail grouse survive in isolated habitats throughout the Section. Waterfowl populations are greatly reduced (except for the Canada goose and sandhill crane), although wetland habitat restoration efforts appear to be helping to stabilize numbers.

Climate. Precipitation averages 25 to 33 in (650 to 850 mm); 35-45 percent falls during the growing season. Temperature averages 39 to 48 °F (4 to 9 °C). The growing season lasts 120 to 160 days.

Surface Water Characteristics. Most of the Section is characterized by a scarcity of natural lakes and wetlands; there are fairly well developed drainage networks with relatively slow-flowing streams. The exception is approximately the northern one-fourth to one-fifth of the Section, where several natural lakes, common wetlands, and undeveloped surface drainage networks are associated with end moraines.

Disturbance Regimes. Fire was historically important in oak savanna development. Windthrow was common in the sugar maple-basswood forests. tornadoes and other high wind events and floods also created natural disturbances. Major anthropogenic disturbances during the past 100 to 150 years have included logging and clearing for agriculture.

Land Use. Agriculture is currently the major land use. Some forest land, used primarily for wildlife habitat and recreation, remains on steep landscapes and adjacent to streams and lakes. Major urban and industrial development is associated mainly with the Minneapolis-St. Paul, Minnesota metropolitan area.

Cultural Ecology. Humans have occupied the area for at least 10,000 years, adapting their ways of life in a variety of changing environments. Conditions have varied from cool, wet, tundra supporting herds of open land grazing animals such as bison and caribou; through a warm, dry savanna period when availability of water and aquatic resources was drastically altered; to the hardwood forest and tall grass prairie of the present. People lived in small nomadic groups and larger villages, changing their hunting, fishing, and gathering methods as environmental conditions changed, to allow for the most efficient resource use. Horticulture has been practiced for about 1,000 years. Within the last 300 years, the near extinction of some species of fur-bearing mammals for the fur trade, the cutting of the "Big Woods" forests by logging, and cultivation of the land have significantly altered the environment. Farming, industrialization, concentrated human settlement, and recreation are the major human activities affecting the ecosystem today.

Compiled by Eastern Region and Minnesota Department of Natural Resources.

Section 222N–Lake Agassiz, Aspen Parklands

Geomorphology. This Section is part of the Central Lowlands geomorphic province. It forms the southeastern margin of a large, level lake plain (created by glacial Lake Agassiz) that extends far to the north and west into Manitoba, Saskatchewan, and Alberta. Low dunes and wet swales mark the Section's western edge; prominent beach and morainal ridges cross the Section in several places. Drainage is dendritic, with only minor entrenchment. Geomorphic processes operating in the Section are fluvial erosion, transport and deposition. Elevation ranges from 900 to 1,250 ft (270 to 380 m). Local relief is low; most areas are nearly level. The western edge has up to 50 to 150 ft (15 to 45 m) of local relief along beach ridges.

Lithology and Stratigraphy. This Section is covered by Pleistocene (Wisconsinan) glacial drift, ranging in thickness from 100 to 400 ft (30 to 120 m): calcareous tills, lacustrine silt-clay-peat-muck, and beach sands. Holocene peats cover some of the Pleistocene deposits. Bedrock beneath the drift and peat is composed of Archaean granite, greenstone, and metasediments. Bedrock is not exposed.

Soil Taxa. The dominant soil orders are Entisols, Histosols, and Mollisols, with frigid temperature regime and dominantly aquatic moisture regime.

Potential Natural Community. Küchler mapped this area as bluestem prairie and oak savanna, with a minor component of maple-basswood forest. Local investigators indicate the pre-European settlement vegetation was primarily aspen savanna, with significant components of tallgrass prairie, wet prairie, and dry gravel prairie (on gravelly beach ridges.)

Fauna. This Section represents the meeting of the northern plains of the west and the northern hardwoods of the upper midwest; it contained diverse populations of wildlife. Bison and elk were common. The dominant large predator was the wolf. Prairie chicken, sharptail grouse, jack rabbit, coyote, and fox were common. The bison and elk were extirpated, but the wolf may range into the Section from the northeastern Minnesota area. Coyote and fox are numerous, and the prairie chicken and

sharptail grouse survive in isolated habitats throughout the Section. Waterfowl populations are greatly reduced (except for the Canada goose and sandhill crane), although wetland habitat restoration efforts appear to be helping to stabilize numbers.

Climate. Precipitation averages 20 to 22 in (510 to 560 mm). About 40 percent falls during the growing season. Snowfall is 40 to 50 in (1,000 to 1,270 mm). Temperature averages 37 to 41 °F (3 to 5 °C). The growing season lasts about 120 days.

Surface Water Characteristics. Drainage network is not well developed. Streams meander and flow slowly. Flooding is common. Drainage is to the north and west, to Hudson Bay. The major drainage is the Roseau River.

Disturbance Regimes. Fire was the most common natural disturbance, followed by floods and tornadoes. Fire frequency and intensity were reduced by the natural barrier of low dunes, beach ridges, and wet swales that mark the western edge of the Section.

Land Use. Agriculture is the current dominant land use, including extensive areas recently cleared for farming.

Cultural Ecology. Humans have occupied the area for at least 10,000 years, adapting their ways of life in a variety of changing environments. Conditions have varied from cool, wet tundra supporting herds of open land grazing animals such as bison and caribou; through a warm, dry savanna period when availability of water and aquatic resources was drastically altered; to the mixed deciduous-coniferous forests of the present. People lived in small nomadic groups and larger villages, changing their hunting, fishing, and gathering methods as environmental conditions changed, to enable the most efficient resource use. Within the last 300 years, the near extinction of some species of fur-bearing mammals for the fur trade, the cutting of the pine forests by logging, and cultivation of the land have significantly altered the environment. Today, farming, logging, and recreation are the major human activities affecting the ecosystem.

Compiled by Eastern Region and Minnesota Department of Natural Resources.

Province M221–Central Appalachian Broadleaf Forest - Coniferous Forest - Meadow

Four Sections have been delineated in this Province: M221A–Northern Ridge and Valley; M221B–Allegheny Mountains; M221C–Northern Cumberland Mountains; and M221D–Blue Ridge Mountains. These Sections are located in the eastern conterminous States, including parts of Georgia, North and South Carolina, Virginia, West Virginia, Maryland, and Pennsylvania. The area of these Sections is about 68,100 mi² (176,400 km²).

Section M221A–Northern Ridge and Valley

Geomorphology. This Section forms part of the Ridge and Valley geomorphic province. It is characterized by a series of parallel, southwest to northeast trending, narrow valleys and mountain ranges (high ridges) created by differential erosion of tightly folded, intensely faulted bedrock. The eastern boundary is the Great Valley low land; the western boundary is a steep, high ridge, the Allegheny Front. Drainage is structurally controlled, dominantly trellis with some dendritic patterns. Mass wasting, karst solution, and fluvial erosion, transport and deposition are the dominant geomorphic processes currently active. A notable but very minor landform is anthropogenic: lands that have been strip-mined exhibit hummocky or gouged topography. Elevation ranges from 300 to 4,000 ft (100 to 1,200 m). Local relief is 500 to 1,500 ft (150 to 450 m).

Lithology and Stratigraphy. A veneer of unconsolidated materials overlies most bedrock. residuum on flat and gently sloping uplands, colluvium on slopes, and alluvium in valley bottoms. Shale, siltstone, sandstone, chert, and carbonates form bedrock in the Section. Ordovician and Silurian units dominate the northern part of the Section, with some Devonian, Mississippian, and Pennsylvanian units (including coal) exposed in the larger synclines, and Cambrian limestone exposed in a few anticlines. The southern part is dominated by Devonian units with lesser amounts of Silurian and Ordovician rocks in some anticlines, and Mississippian and Pennsylvanian rocks in some synclines. Cambrian rocks show up along a few major thrust faults. Sandstone, chert, and some of the tougher carbonates hold up most of the upland portions of the Section. Weaker carbonates and shale underlie most valleys.

Soil Taxa. Soils are mostly Ultisols, Alfisols, and Inceptisols, with mesic temperature regimes and mostly udic moisture regime. They are derived from heavily-weathered shale, siltstone, sandstone residuum and colluvium, cherty limestone, and limestone residuum.

Potential Natural Vegetation. Because much of this area lies in the rain shadow of the Allegheny Mountains Section, vegetation reflects drier conditions. Küchler

types are mapped as Appalachian oak forest, oak-hickory-pine forest, and some northern hardwoods forest. Braun classified much of the area as oak-chestnut. Before arrival of the blight that decimated the chestnut, this Section was a stronghold of the species. Oaks now dominate. As a broad generalization, red and white oaks occur on more productive, mesic sites. Eastern white pine can occur, with white oak on the lower portions of slopes. Scarlet and black oaks are more common on drier sites. On the driest sites, oaks are mixed with pitch, table mountain, or Virginia pines. The latter can also occur as pure stands.



Ridge and valley pattern of landforms in eastern West Virginia.

Fauna. The black bear is the sole representative of large carnivores. Prior to European settlement, forests featured wolves and mountain lions, but they were hunted or trapped to local extinction. Woodland bison and eastern elk were the largest herbivores of this Section, but were eliminated by subsistence hunting. White-tailed deer are abundant and can have a major impact on understory flora. Smaller mammals include the gray and fox squirrels, deer mouse, meadow jumping mouse, weasels, and bats. The endangered Virginia big-eared and Indiana bats are associated with karst areas. Bird species are diverse and include a wide variety of both residents and neotropical migrants. Game birds include ruffed grouse and wild turkey. Bald eagles and peregrine falcons were never abundant historically. In

recent years eagles have entered the area, and falcons have been reintroduced. Fish species include brook trout and sculpins at higher elevations, with the addition of smallmouth bass, rock bass, minnows, and darters at lower elevations. Amphibians and reptiles are abundant. Insect life is highly diverse. Some butterfly and moth species are still being identified. In recent years, gypsy moth has entered the area and become established.

Climate. Mean annual precipitation is generally 30 to 45 in (76 to 1,140 mm). In the transition to the Allegheny Plateau, rainfall may range as high as 60 in (1,520 mm). Approximately 20 percent of these totals falls as snow. At elevations above 3,500 ft (1,200 m) 30 percent falls as snow. Mean annual temperature is approximately 39 to 57 °F (4 to 14 °C). The growing season ranges from 120 to 180 days, with local variation.

Surface Water Characteristics. Streams are most active in the spring, reflecting relatively frequent rainfall and snowmelt. Many smaller streams dry up in the summer and are not recharged until October to November. This Section includes the headwaters of the Potomac and Greenbrier Rivers. Stream patterns are trellis shaped, reflecting the regular folding of the geomorphology. Streams are generally more alkaline and productive than in the Allegheny Mountains. Wetlands are scarce.

Disturbance Regimes. Fire was undoubtedly used extensively by Native Americans. Major historical disturbances include grazing from about 1780 onward and extensive logging from 1880 to 1920. Many logging operations were followed by fire. Since the 1930's many fires have been suppressed through Federal and State agency efforts. Gypsy moth has affected forests in this Section, notably in Virginia.

Land Use. Farming, grazing, and hay production are common on river flood plains and on limestone areas in the Northern Ridge and Valley Section. On forested sites, timber production is an important industry. This Section receives light but extensive recreation pressure for fishing, hunting, camping, and hiking. Canoeing and rock climbing occur in certain areas. Settlements tend to be small and dispersed.

Cultural Ecology. This area has been used by Native Americans for at least 12,000 years. The first people, or Paleo-Indians, inhabited a boreal forest environment. They were highly mobile, sparsely distributed, lived in small family units, gathered plant foods, and were big game hunters. As the climate gradually became more temperate, an Archaic culture replaced the Paleo-Indian. People harvested a greater variety of plants and animals, and human populations increased. Archaic peoples moved seasonally within a well defined geographical area that offered a variety of resources. During the Woodland Period, permanent villages were established in fertile valleys, where agriculture was first attempted, while the uplands continued to be used for hunting and gathering. Fire may have been used to drive game, clear fields for

agriculture, or open areas to improve hunting. From the start of European settlement, transportation was limited by the severity of the terrain. Because of crop failures on mountain farms, grazing came to dominate the area, and its influence continues. Farmers often created open grassy areas or sods by cutting the timber, removing the logs, and burning the slash. From 1880 to 1920, major logging and sawmilling denuded the landscape. Fires raged throughout the forest, laying soils open to erosion. Today, extractive industries prevail, along with an insular traditional mountain culture. Increasingly, however, a more recreation-oriented lifestyle has emerged to cater to the needs of urban dwellers from East Coast metropolitan areas.

Compiled by Eastern Region and Northeastern Area State and Private Forestry.

Section M221B-Allegheny Mountains

Geomorphology. This Section comprises part of the Appalachian Plateaus geomorphic province. It is a maturely dissected plateau characterized by high, sharp ridges, and low mountains, and narrow valleys. It has a prominent structural and topographic grain created by broad, northeast to southwest trending folds in the bedrock. Drainage is dendritic to trellis, but primarily the former. Mass wasting, karst solution, and fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation ranges from 1,000 to 4,500 ft (300 to 1,400 m), with a few peaks higher, notably Spruce Knob (4,861 ft, 1,620 m), the highest point in West Virginia. Local relief generally ranges from 1,000 to 2,500 ft (300 to 600 m).



Portion of the Allegheny Mountains in eastern West Virginia.

Lithology and Stratigraphy. Bedrock is overlain by residuum on the ridges and mountain tops, colluvium on the slopes, and alluvial materials in the valleys. Devonian shale and siltstone, Mississippian carbonates and sandstones, and Pennsylvanian shale, sandstone, and coal form bedrock in the Section. Sandstone and some of the tougher carbonates hold up most of the upland portions; weaker carbonates and shale underlie most valleys.

Soil Taxa. Soils are dominantly Ultisols, Inceptisols, and Alfisols, with mesic temperature regime and udic moisture regime. They are derived from heavily weathered shales, siltstones, sandstone residuum and colluvium, and limestone residuum. Spodosols with frigid temperature regime and aquic moisture regime occur in isolated pockets at the highest elevations.

Potential Natural Vegetation. Küchler mapped this Section as northeastern spruce-fir, northern hardwoods, mixed mesophytic, and oak-hickory-pine. Strongly influenced by elevation and aspect, the vegetation of the Allegheny Mountains can be placed in four broad groups: red spruce, northern hardwoods, mixed mesophytic, and oaks. Red spruce is characteristic above 3,500 ft (1,060 m) and includes stands of American beech and yellow birch. Beech is more common on northerly aspects, and yellow birch on southerly. The northern hardwood group features sugar maple occurring with beech and black cherry. The mixed mesophytic represents a transition to drier types and presents a wide variety of successional pathways. Characteristic species are red oak, basswood, white ash, and tulip poplar. The productive, diverse cove hardwoods are included in this group. Oak sites occur mostly on foothills, but are much less common in this Section than in the Northern Ridge and Valley Section.

Fauna. The black bear is the sole representative of large carnivores. Prior to European settlement, forests featured wolves, fishers, and mountain lions—but all were hunted or trapped to local extinction. Fishers have since been reintroduced with modest success. White-tailed deer are abundant and can impact understory flora. Woodland bison and eastern elk were found in this area as late as 1825 and 1887, respectively, but were then exterminated by subsistence hunting. Varying hare, red squirrel, and the endangered Virginia northern flying squirrel are associated with the red spruce vegetation zone (above 3,500 ft). Elsewhere gray and fox squirrels are more abundant. Throughout the Section, smaller mammals include the deer mouse, meadow jumping mouse, and various weasels, and bats. Bird species include a wide variety of both residents and neotropical migrants. Ruffed grouse and wild turkey are prominent game species. Fish species include brook trout and sculpins at higher elevations, with the addition of smallmouth bass, rock bass, minnows, and darters at lower elevations. The Cheat minnow is listed as a sensitive species, and some minnow and darter species in the New River basin are endemic. Amphibians and reptiles are abundant. The threatened Cheat Mountain salamander is found on high elevation red spruce and northern hardwood sites. Insect life is highly diverse. New butterfly and moth species are still being identified. Gypsy moth is now entering this Section.

Climate. Precipitation typically averages 45 to 60 in (1,140 to 1,520 mm) per year; about 20 percent of this is snow (30 percent at higher elevations). On average, this Section is notably moister than the Northern Ridge and Valley Section. Mean annual temperature is approximately 39 to 54 °F (4 to 12 °C). The growing season ranges from 140 to 160 days, with local variation.

Surface Water Characteristics. The drainage pattern is well established, dendritic to trellis, but primarily the former. This Section contains headwaters of the Cheat and Greenbrier Rivers, both of which eventually feed through other tributaries into the Ohio River. Streams are generally more acidic and less productive than in the Northern Ridge and Valley Section. Wetlands are scarce.

Disturbance Regimes. Erosional processes over eons have been the primary disturbance agents. In the pre-European settlement era, fire was not a significant element of change because of the relatively high precipitation. The current forest was largely shaped by logging and associated fires from about 1880 to 1920. In some areas, notably those in the red spruce zone above 3,500 ft (1,200 m) elevation, some areas burned so severely that soil was removed to the bedrock. These areas are now stunted forests with blueberry understories. Gypsy moth is now entering this Section. Its effect on this Section may be less than on the Northern Ridge and Valley Section, because oak, preferred by the moth, is less extensive here.

Land Use. Timber production of high-valued hardwoods is a major industry. Agricultural pastures and hay meadows are common on river and stream flood plains and on limestone soils. Recreation use is relatively light but extensive, and includes hunting, fishing, camping, and hiking. Tourism is a growing industry. Settlements are small and dispersed. Strip-mining for coal has been and continues to be an important activity in some parts of this Section.

Cultural Ecology. This area has been used by Native Americans for at least 12,000 years. The first people, or Paleo-Indians, inhabited a boreal forest environment. They were highly mobile, sparsely distributed, lived in small family units, gathered plant foods, and were big game hunters. As the climate gradually became more temperate, an Archaic culture replaced the Paleo-Indian. People harvested a greater variety of plants and animals, and human populations increased. Archaic peoples moved seasonally within a well defined geographical area that offered a variety of resources. During the Woodland Period permanent villages were established in fertile valleys, where agriculture was first attempted, while the uplands continued to be used for hunting and gathering. Fire may have been used to drive game, clear fields for agriculture, or open areas to improve hunting. From the start of European settlement, transportation was limited by the severity of the terrain. Because of crop failures on mountain farms, grazing came to dominate the area, and its influence continues. Farmers often created open grassy areas or sods by cutting the timber, removing the logs, and burning the slash. From 1880 to 1920, major

logging and sawmilling denuded the landscape. Fires raged throughout the forest, laying soils open to erosion. Today extractive industries prevail, along with an insular traditional mountain culture. Increasingly, however, a more recreation-oriented lifestyle has emerged to cater to the needs of urban dwellers from East Coast metropolitan areas.

Compiled by Eastern Region and Northeastern Area State and Private Forestry.

Section M221C–Northern Cumberland Mountains

Geomorphology. This section is in the Appalachian Plateaus geomorphic province. Synclinal structure resulting from folding, faulting, and uplift, followed by differential erosion, has resulted in long monoclinical mountains and dissected uplands. Landforms are mainly low mountains where less than 20 percent of the area is gently sloping. Drainage is dendritic to trellis; mass wasting, karst solution, and fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation ranges from 2,000 to 2,600 ft (600 to 800 m). Local relief ranges from 100 to 300 ft (30 to 90 m).

Lithology and Stratigraphy. Bedrock is overlain by a veneer of residuum on the ridges and mountain tops, colluvium on the slopes, and alluvial materials in the valleys. Pennsylvanian sandstone caps most uplands, including the linear mountains. Pennsylvanian shale and coal, and Mississippian sandstone, shale, and limestone form bedrock on the slopes and underlie most valleys.

Soil Taxa. Soils are mainly Ochrepts, Udults, and Aquults. On plateaus and upper slopes, Dystrochrepts, Hapludults, and Fragiudults have formed in material weathered from sandstone, siltstone, and shale on nearly level surfaces. Ochraqults are along foot slopes in weathered shale. Dystrochrepts have formed in alluvium. Soils have a mesic temperature regime, an udic or aquic moisture regime, and mixed mineralogy.

Potential Natural Vegetation. Kuchler classified vegetation as mixed mesophytic forest, Appalachian oak forest, and northern hardwoods. The predominant vegetation form is cold-deciduous broad-leaved forest with a mixture of evergreen needle-leaved trees. Existing forest types consist of oak-hickory. The component consists of white, black, scarlet, and blackjack oaks; common hickories include mockernut and pignut.

Fauna. The white-tailed deer occurs throughout much of this Section. The oak forest and the openings and farms within it provide food and cover for a varied fauna. The black bear is present in many areas. The wolf is no longer common, but the red fox and gray fox are widespread, as is the bobcat. Several species of squirrels are in the forest, and a number of smaller rodents inhabit the forest

floor. The turkey, ruffed grouse, bobwhite, and mourning dove are game birds in various parts of this Section. Songbirds include the ovenbird, red-eyed vireo, hermit thrush, scarlet tanager, blue jay, black-capped chickadee, wood pewee, magnolia warbler, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake, and timber rattlesnake.

Climate. Precipitation averages 40 to 47 in (1,020 to 1,200 mm); snow averages about 35 in (900 mm). Mean annual temperature averages 45 to 50 °F (7 to 10 °C). The growing season lasts 140 to 160 days.

Surface Water Characteristics. There is a moderate density of small to medium intermittent and perennial streams and associated rivers, most with low to moderate rates of flow. A dendritic drainage pattern has developed with influence from the underlying bedrock.

Disturbance Regimes. Fire has probably been the principal historical source of disturbance. Climatic influences include occasional summer droughts and ice storms.

Land Use. Natural vegetation has been cleared for agriculture on most of the area. Strip mining for coal has disturbed about 5 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region.

Section M221D–Blue Ridge Mountains

Geomorphology. This Section is in the Blue Ridge geomorphic province. The Section was formed by tectonic faulting and uplift of resistant, crystalline bedrock into a relatively narrow band of highly metamorphosed, somewhat parallel mountain ranges. The northern part of this Section (north of Roanoke Gap in Virginia) is characterized by a single, broad (5 to 10 mi, 8 to 16 km) ridge that extends into southern Pennsylvania. The southern half of the Section is broader, higher, more mountainous, and displays little or no structural grain. Though high (46 peaks are over 6,000 ft (1,820 m) in elevation), the mountains are rounded and generally lack prominent angularity. Drainage is structurally controlled, dominantly trellis in the north; dendritic patterns dominate the southern half. Landforms on about 80 percent of the Section are low mountains. The remainder of the Section is open, low mountains. Elevation ranges from 1,000 to over 6,000 ft (300 to 1,800 m). Local relief ranges from 500 to 1,000 ft (150 to 300 m). Mt. Mitchell, the highest point in eastern North America (6,684 ft, 2,025 m), occurs here.

Lithology and Stratigraphy. Bedrock is overlain by a veneer of residuum on the ridges and mountain tops, colluvium on the slopes, and alluvial materials in



Oaks dominate the low elevation, broadly rounded peaks and lateral ridges of the southern Appalachian Mountains in the Pisgah National Forest.

the valleys. Although structural grain is not evident in the south half, the whole Section is bounded on the eastern and western margins by southwest to northeast trending thrust faults, between more faults and tight folds. Bedrock is composed primarily of Proterozoic metasediments (quartzite, schist, and gneiss) and meta-igneous rocks (granite, rhyolite, basalt, and gabbro). Smaller areas underlain by Paleozoic granite occur along the eastern edge of the Section, with lower Cambrian sandstone, shale and dolomite, and broad zones of intensely sheared and altered rock. The Lower Cambrian rocks occur intermittently along the western edge as well.

Soil Taxa. Soils are dominated by Ochrepts and Udults. Dystrochrepts are on steep slopes of lower elevation mountains. Hapludults are on the low foothills, and Haplumbrepts have formed on foot slopes and in valleys. Haplumbrepts are also common at higher elevations, while Hapludults are dominant in broad valleys. Rhodudults have formed over rocks with a high content of mafic minerals. Soils are generally moderately deep and medium textured. Boulders and bedrock outcrops are common on upper slopes, but are not extensive. These soils have a mesic temperature regime, a udic moisture regime, and mixed mineralogy. Similar soils with a frigid temperature regime are typically present at elevations above 4,800 feet. Soils receive adequate moisture for growth of vegetation throughout the year.

Potential Natural Vegetation. Küchler classified vegetation in this Section as Appalachian oak forest, southeastern spruce-fir forest, and northern hardwoods. The predominant vegetation form is montane cold-deciduous broad-leaved forest dominated by the genus *Quercus*. The oak forest type consists of black, white, and chestnut oaks that dominate dry mountain slopes; pitch pine is often a component along ridge tops. Mesophytic species such as yellow-poplar, red maple, northern red oak, and sweet birch dominate the valleys and moist slopes. Smaller areas of cold-deciduous broad-leaved forest with evergreen needle-leaved trees are present in the intermontane basins, with the hardwood-pine cover type of scarlet, white, blackjack, and post oaks and shortleaf and Virginia pines. Table Mountain pine, a fire-dependent species with serotinous cones, occurs on xeric ridge tops where fire was historically more common. Eastern white pine dominates small areas of coarse-textured soils and parts of the Blue Ridge escarpment joining the Southern Appalachian Piedmont Section. Mesic sites at higher elevations (4,500 ft, 1,360 m) are occupied by northern hardwoods (e.g., sugar maple, basswood, and buckeye); drier sites are dominated by northern red oak. The broad-leaved forest changes to evergreen needle-leaved forest with conical crowns (e.g., red spruce, Fraser fir) above altitudes of about 5,000 to 6,000 ft (1,800 m).

Fauna. Many species of small mammals and birds with northern or boreal affinities reach their southernmost range in eastern North America in the Blue Ridge

Section. These include the New England cottontail rabbit, northern water shrew, rock vole, northern flying squirrel, Blackburnian warbler, and saw-whet owl. This Section supports the largest diversity of salamanders in North America. At least 12 species of the genus *Plethodon* and six species of the genus *Desmognathus* are endemic to the Blue Ridge Section. Most endemic species are found in the central and southern subsections, where topographic relief is greater, peaks are more isolated, and higher rainfall occurs. Disjunct and isolated populations of the green salamander and bog turtle are found in the southernmost subsection.

Climate. Average precipitation is 40 to 50 in (1,020 to 1,270 mm) but ranges up to 60 in (1,500 mm) on the highest peaks. Only 35 to 40 in (900 to 1,020 mm) fall in the Asheville Basin, an area surrounded by higher mountains. Along parts of the southern Blue Ridge escarpment bordering the Southern Appalachian Piedmont Section, rainfall averages over 80 in (2,000 mm); the highest in the eastern U.S. Precipitation is about equally distributed throughout the year and relatively little occurs as snow. Mean annual temperature is 50 to 62 °F (10 to 16 °C) and ranges from 38 °F (3 °C) in January to 76 °F (24 °C) in July. The growing season lasts 150 to 220 days, but varies according to elevation and the influence of local topography.

Surface Water Characteristics. There is a high density of small to medium size perennial streams and associated rivers; those in intermountain basins have moderate rates of flow. Some streams on mountainous areas in zones of high rainfall are characterized by high rates of flow and velocity. A dendritic drainage pattern has developed on deeply dissected surfaces, with some control from the underlying bedrock. Isolated areas in some locations are wet all year as a result of seeps. The largest rivers are the French Broad and Little Tennessee.

Disturbance Regimes. Fire, wind, ice, and precipitation are the principal causes of natural disturbance. It is believed that native Americans used fire for many purposes, especially at low elevations in intermountain basins, where drier conditions prevail. Fire caused by lightning is more prevalent in some areas, especially in

the vicinity of Grandfather Mountain. Tornadoes are uncommon, but more prevalent are localized "micro-bursts" of intense winds, which cause small patches of trees to be up-rooted, especially on mountain slopes. Winter ice storms are not uncommon at mid-to-high elevations and cause extensive damage to tree crowns. Occasional events of prolonged, intense precipitation cause localized scouring and erosion of drainage channels, followed by siltation, sedimentation, and flooding downstream. An introduced pathogen, the chestnut blight, caused considerable disturbance to composition of most forest stands from 1920 to 1940 by top-killing all American chestnut trees. Gypsy moth has not affected forests in the central and southern subsections, but has the potential to cause a major impact on forest vegetation because of the dominance by oaks.

Land Use. Natural vegetation has been cleared for agriculture and urban development on about 35 percent of the area, mostly in broad valleys between major mountain ranges.

Cultural Ecology. Cherokee Indians have inhabited this Section for thousands of years and, it is thought, extensively used fire for agricultural and hunting purposes. European settlement began in the late 1700's and consisted of subsistence agriculture and hunting throughout the intermountain basins and larger coves. By 1840, the Cherokee Indians had been displaced by settlers. Many of the Eastern Cherokee Indians occupy a reservation in western North Carolina. Population growth in the Section has been relatively slow, limited somewhat by unfavorable terrain for large commercial development. However, a favorable climate and scenic views have caused tourism to be a major part of the economy since the early 1900's; more recently the retirement community has increased rapidly. Some permanent and seasonal residents advocate reduced forest and resource management on National Forests, which occupy much of the mountain slopes in some areas. Hunting, hiking, and trail biking are major forest recreational uses. Two national parks were authorized in 1926, the Great Smoky Mountains (517,014 ac, 1,277,024 ha) in western North Carolina and Shenandoah (193,000 ac, 476,000 ha) in northern Virginia. The Parks are connected by the 469 mi (750 km) long Blue Ridge Parkway, which follows the highest ridge lines. Limited high-quality water supplies, waste disposal, and air pollution have caused concern about the pace of future development.

Compiled by Southeastern Forest Experiment Station.

Province M222–Ozark Broadleaf Forest - Meadow

One Section has been delineated in this Province: M222A–Boston Mountains. Located in parts of Arkansas and Oklahoma, the area of this Section is about 6,400 mi² (16,600 km²).

Section M222A–Boston Mountains

Geomorphology. This Section is in the Ozark Plateau geomorphic province. Geomorphic characteristics include broad uplift of generally flat-lying marine sediments to a plateau, followed by fluvial erosion, resulting in a strongly dissected region with dendritic drainages. About 80 percent of the Section has landforms of low mountains; 20 percent consists of open hills and plains with hills. Elevation ranges from 650 to 2,600 ft (20 to 80 m). Local relief ranges from 100 to 800 ft (30 to 240 m).

Lithology and Stratigraphy. Rocks in this Section formed during the Paleozoic Era. Geologic strata consist of 20 percent Mississippian marine deposits (cherts and limestone) and 80 percent Pennsylvanian marine deposits (sandstone, shale, coal, and limestone).

Soil Taxa. Soils are mostly Udults. Hapludults are on ridgetops, benches, and upper slopes. Paleudults and Hapludults occur on middle and lower slopes. Udifluvents and Hapludults are on flood plains, while Fragiudults and Hapludults are on valley terraces. These soils have a thermic temperature regime, a udic moisture regime, and siliceous or mixed mineralogy. Soils are generally medium textured, stony to nonstony, and shallow to moderately deep.

Potential Natural Vegetation. Küchler mapped this area as oak-hickory forest and oak-hickory-pine forest.



Exposed sandstone benches and deciduous hardwood species typical of the Boston Mountains, Ozark National Forest.

Predominant vegetation form is temperate low land and submontane broad-leaved, cold-deciduous forest, with smaller areas of cold-deciduous, broad-leaved forest with evergreen needle-leaved trees. Common oak species in the oak-hickory forest type include white oak, black oak, and northern red oak. Hickories include pignut and mockernut. The shortleaf pine-oak cover type occurs on drier sites where post, scarlet, and blackjack oaks dominate with shortleaf pine.

Fauna. Among the fauna in this Section are white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, eastern chipmunk, white-footed mouse, pine vole, short-tailed shrew, and cotton mouse. The turkey, bobwhite, and mourning dove are game birds in various parts of this Section. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake, and timber rattlesnake.

Climate. Annual precipitation averages 45 to 52 in (1,150 to 1,320 mm). Temperature averages 58 to 64 °F

(14 to 17 °C). The growing season lasts about 180 to 205 days.

Surface Water Characteristics. There is a high density of small to medium size perennial streams and associated rivers; those in intermountain basins have moderate rates of flow, and some on mountain sides are characterized by high rates of flow and velocity. A dendritic drainage pattern has developed on strongly dissected surfaces, largely with influence from the underlying bedrock. The Buffalo River drains much of this Section.

Disturbance Regimes. Reserved.

Land Use. Natural vegetation has been cleared for agriculture on about 25 percent of this area.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Province 231–Southeastern Mixed Forest

Seven Sections have been delineated in this Province: 231A–Southern Appalachian Piedmont; 231B–Coastal Plains, Middle; 231C–Southern Cumberland Plateau; 231D–Southern Ridge and Valley; 231E–Mid Coastal Plains, Western; 231F–Eastern Gulf Prairies and Marshes; and 231G–Arkansas Valley. These Sections are located in the southeastern conterminous States, including parts of Virginia, North and South Carolina, Georgia, Alabama, Mississippi, Arkansas, Louisiana, and Texas. The area of these Sections is about 193,000 mi² (499,900 km²).

Section 231A–Southern Appalachian Piedmont

Geomorphology. This Section is in the Appalachian Piedmont geomorphic province. It consists of an intensely metamorphosed, moderately dissected plain consisting of thick saprolite, continental sediments, and accreted terranes. Differential erosion has produced some isolated mountains (monadnocks) which rise above the general land surface. Landforms on about 70 percent of the Section are irregular plains. Landforms on the remaining area is about equally divided; plains with high hills; open low hills; and tablelands of moderate relief. Elevation ranges from 330 to 1,300 ft (100 to 400 m). Local relief ranges from 100 to 300 ft (30 to 90 m).

Lithology and Stratigraphy. Rock units formed during the Precambrian (60 percent), Paleozoic (30 percent), and Mesozoic (10 percent) Eras. Precambrian strata consist of metamorphic complexes with compositions of schist and phyllite, and mafic paragneiss. Paleozoic strata consist of about equal amounts of Cambrian eugeosynclinal and volcanic rocks. Mesozoic strata consists of Triassic marine deposits (sandstone, siltstone, and shale).

Soil Taxa. Udults are the predominant soils. Paleudults and Hapludults are on gently sloping uplands. Steeper slopes are dominated by Hapludults, Rhodudults, Dystrachrepts, and Hapludalfs. Dystrachrepts, Udifluvents, and Fluvaquents are on alluvium. Soils have a thermic temperature regime, and kaolinitic, mixed, or oxidic mineralogy. Soils are generally deep, with a clayey or loamy subsoil. In many areas soils are severely eroded as a result of past intensive agricultural practices, especially for cotton production.

Potential Natural Vegetation. Küchler mapped this area as oak-hickory-pine forest and southern mixed forest. Predominant vegetation form is evergreen forest with rounded crowns, and about equal areas of cold-deciduous broad-leaved forest with evergreen needle-leaved trees.



The Southern Appalachian Piedmont near Clemson, South Carolina consists of low hills dominated by a mixture of loblolly pine and upland hardwoods, such as southern red oak and sweetgum.

The oak-hickory forest cover type consists of white, post, and southern red oaks, and hickories of pignut and mockernut. The loblolly-shortleaf pine cover type is common on disturbed areas and usually has an understory component of dogwood and sourwood.

Fauna. Among the fauna in this Section are white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, eastern chipmunk, white-footed mouse, pine vole, short-tailed shrew and cotton mouse. The turkey, bobwhite, and mourning dove are game birds in various parts of this Section. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake, and timber rattlesnake.

Climate. Average annual precipitation ranges from 45 to 55 in (1120 to 1400 mm). Temperature averages 58 to 64 °F (14 to 18 °C). The growing season lasts about 205 to 235 days.

Surface Water Characteristics. There is moderate density of small to medium size perennial streams and associated rivers, mostly with low to moderate rates of flow and moderate velocity. A dendritic drainage pattern has developed on moderately dissected surface, with some influence from the underlying bedrock. Many rivers drain this Section, including the Chattahoochee, Ocmulgee, Savannah, Saluda, and Yadkin.

Disturbance Regimes. Fire has probably been the principal historical disturbance, previously burning over small to moderate-size areas between natural barriers with low frequency and low intensity. Climatic influences include occasional summer droughts and winter ice storms, and infrequent tornadoes. Insect-related disturbances are often caused by southern pine beetles.

Land Use. Natural vegetation has been cleared for agriculture on most of the area, especially for cotton production in the 1800's.

Cultural Ecology. Reserved.

Compiled by Southeastern Forest Experiment Station and Southern Region.

Section 231B-Coastal Plains, Middle

Geomorphology. This Section is in the Coastal plains geomorphic province. The predominant landform on about 80 percent of the area consists of moderately dissected, irregular plains of marine origin formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Elevation ranges from 80 to 650 ft (25 to 200 m). Local relief ranges from 100 to 300 ft (30 to 90 m).

Lithology and Stratigraphy. Rocks unit formed during the Mesozoic (40 percent) and Cenozoic (60 percent) Eras. Mesozoic strata consist of Cretaceous marine sediments (sands and clays). Cenozoic strata consists of Tertiary marine deposits (siliceous strata with lignitic, sandy, and argillaceous deposits).

Soil Taxa. Soils are mostly Udults. Paleudults and Hapludults are on level to strongly sloping uplands. Loamy Fragiudults and Paleudults are present on less sloping, moderately well drained areas. Small but significant areas of Quartzipsamments, Paleudalfs, and Glossaqualfs are present in localized areas. Albaquults and Paleaquults are found on low wetlands. Bottom land soils may be dominated by Fluvaquents and Dystrochrepts. The soils have a thermic temperature regime, an udic moisture regime, a loamy or sandy surface layer, and a loamy or clayey subsoil. Soils generally are deep, well to poorly drained, and have adequate moisture for use by vegetation during the growing season.

Potential Natural Vegetation. Küchler mapped vegetation as oak-hickory-pine forest, blackbelt, and oak-hickory forest. The predominate vegetation form is evergreen, needle-leaved forest with cold-deciduous, broad-leaved trees. The principal forest cover type consists of loblolly and shortleaf pine with hardwoods, including sweetgum, flowering dogwood, elm, red cedar, southern red oak, and hickories. In central Mississippi and Alabama the hardwood component may be dominant, depending on soil moisture regime and past disturbance. A narrow band of oak-hickory forest type occurs along the extreme western edge of the Section, adjacent to floodplains of the Mississippi River and along major river bottoms.

Fauna. Among the fauna in this Section are white-tailed deer, black bear, bobcat, gray fox, raccoon, gray squirrel, fox squirrel, eastern chipmunk, white-footed mouse, pine vole, short-tailed shrew, and cotton mouse. The turkey, ruffed grouse, bobwhite, and mourning dove are game birds in various parts of this Section. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake and timber rattlesnake.

Climate. Precipitation averages 40 to 60 in (1,020 to 1,520 mm). Temperature averages 60 to 68 °F (16 to 20 °C). The growing season lasts about 200 to 280 days.

Surface Water Characteristics. There is a moderate density of small to medium perennial streams and associated rivers, most with moderate volume of water at low velocity. Dendritic drainage pattern has developed on this moderately dissected plain, largely without bedrock structural control.

Disturbance Regimes. Fire has probably been the principal historical disturbance. Climatic influences include occasional summer droughts and winter ice

storms, and infrequent tornadoes. Insect disturbances are often caused by southern pine beetles.

Land Use. Natural vegetation has been cleared for agriculture on about 30 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region and the Southeastern Forest Experimental Station.

Section 231C—Southern Cumberland Plateau

Geomorphology. This Section is in the Appalachian Plateaus geomorphic province. It was formed by the broad uplift of gently-dipping strata to a level-bedded plateau, followed by fluvial erosion and mass wasting. The result of these geomorphic processes is a strongly dissected region of dendritic drainages. About 60 percent of this Section consists of open hills. Other landforms consist of tablelands of considerable relief and open high hills. Elevation ranges from 330 to 1,300 ft (100 to 400 m). Local relief ranges from 300 to 500 ft (90 to 150 m).

Lithology and Stratigraphy. Rock units formed during the Paleozoic Era. Strata consist of 5 percent Mississippian marine deposits (shales, limestone, and chert); 90 percent Pennsylvanian marine deposits (sandstone, shale, coal, and limestone); and 5 percent other Paleozoic marine deposits.

Soil Taxa. Soils are mainly Udults and Ochrepts. Hapludults are on plateaus and upper slopes. Deep Hapludults are present on level sites. Hapludults and Fragiudults are found on level uplands. Upper valley slopes and ridgetops are dominated by Dystrochrepts. Hapludults and Paleudults are found on lower side slopes and terraces. Rock outcrops are common, but not extensive. Soils have a udic moisture regime, a thermic temperature regime, and mixed mineralogy. Most soils are fine textured, deep, and moist during the growing season.

Potential Natural Vegetation. Küchler mapped vegetation as oak-hickory-pine forest and southern mixed forest. The predominant vegetation form consists of needle-leaved, evergreen trees with cold-deciduous, broad-leaved forest. Principal species include loblolly pine, sweetgum, water oak, red maple, southern red oak, and white oak.

Fauna. Among the fauna in this Section are white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, eastern chipmunk, white-footed mouse, pine vole, short-tailed shrew, and cotton mouse. The turkey, bobwhite, and mourning dove are game birds in various parts of this Section. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake and timber rattlesnake.

Climate. Mean annual precipitation is 50 to 55 in (1,270 to 1,400 mm). Temperature averages 60 to 62 °F (16 to 17 °C). The growing season lasts for 200 to 210 days.

Surface Water Characteristics. There is a moderate density of small to medium size perennial streams and associated rivers, mostly with low to moderate rates of flow and moderate velocity. Dendritic drainage pattern has developed, with influence from the underlying bedrock.

Disturbance Regimes. Fire has probably been the principal historical disturbance. Climatic influences include occasional summer droughts, winter ice storms, and occasional tornadoes.

Land Use. Natural vegetation has been cleared for agriculture on about 30 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southeastern Forest Experiment Station and Southern Region.

Section 231D—Southern Ridge and Valley

Geomorphology. This Section is in the Ridge and Valley geomorphic province. The area is a folded, faulted, and uplifted belt of parallel valleys and ridges, strongly dissected by differential erosion, mass wasting, and fluvial erosion and transport and deposition. About 60 percent of this Section consists of plains with hills and 40 percent consists of open high hills. Elevation ranges from 650 to 2,000 ft (200 to 600 m). Local relief ranges from 300 to 500 ft (90 to 150 m) in areas of plains, with elevation ranging from 500 to 1,000 ft (150 to 300 m) in areas of high hills).

Lithology and Stratigraphy. Rock units in this Section formed during the Paleozoic Era. Strata consists of a mosaic of marine deposits of Lower Cambrian clastic rocks (granites), and a mixture of marine deposits of Cambrian (carbonates and shales), Lower Ordovician (carbonates), and Mississippian (shales, limestone, and chert) ages.

Soil Taxa. Soils are mostly Udults with some Ochrepts. Paleudults dominate upland areas underlain by limestone. Hapludults are in valleys underlain by shale. Dystrochrepts are common on side slopes of ridges. Hapludolls and Eutrochrepts are on bottom lands. Soils have an udic moisture regime and thermic or mesic temperature regime. Almost all soils are well drained. Soils range from shallow on sandstone and shales to very deep on limestone formations.

Potential Natural Vegetation. Küchler mapped vegetation as oak-hickory-pine forest and southern mixed forest. The predominant vegetation form is needle-leaved, evergreen trees with cold deciduous, broad-leaved forest. The principal cover type is oak-hickory, which includes



The Southern Ridge and Valley Section, which extends into the Chattahoochee National Forest, consists of long parallel ridges. The steep-sided ridges are separated by long, broad valleys.

southern red oak, white oak, post oak, red maple, winged elm, flowering dogwood, pignut hickory, and loblolly pine. In some areas, loblolly and shortleaf pines are dominant.

Fauna. Among the fauna in this Section are white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, eastern chipmunk, white-footed mouse, pine vole, short-tailed shrew, and cotton mouse. The turkey, bobwhite, and mourning dove are game birds in various parts of this Section. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake and timber rattlesnake.

Climate. Precipitation averages 36 to 55 in (900 to 1,400 mm) annually. Mean annual temperature is from 55 to 61 °F (13 to 16 °C). The growing season lasts about 170 to 210 days.

Surface Water Characteristics. This Section has a moderate density of small to medium size perennial streams and associated rivers, mostly with low to moderate rates of flow and moderate velocity. Trellis drainage pattern has developed with bedrock structural control. One of the major rivers draining this Section is the Coosa.

Disturbance Regimes. Fire has probably been the principal historical disturbance, previously burning over small areas between natural barriers with moderate frequency and low intensity. Insect related disturbances have resulted from southern pine beetles. Climatic related influences include occasional droughts and ice storms.

Land Use. Natural vegetation has been cleared for agriculture on over 60 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Section 231E—Mid Coastal Plains, Western

Geomorphology. This Section is in the Coastal Plains geomorphic province. The predominant landform occupying about 80 percent of the Section consists of moderately dissected irregular plains of marine origin. The plains were formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Other landforms consist of plains with hills and smooth plains. Elevations range from 80 to 650 ft (25 to 200 m). Local relief ranges from 100 to 300 ft (30 to 90 m).

Lithology and Stratigraphy. Rock units formed during the Cenozoic Era. Strata consist of Tertiary marine deposits (glauconitic sands and clays with lenses of coquina limestone; clay and silty clay).

Soil Taxa. Soils are predominantly Udults. Paleudults, Hapludults, Hapludalfs, Paleudalfs, and Albaqualfs are on uplands. Fluvaquents, Udifluvents, Eutrochrepts, and Glossaqualfs are on bottom lands along major streams. Soils have a thermic temperature regime, a udic moisture regime, and siliceous or mixed mineralogy. Most soils have formed from sandstone and shale parent materials. Soils are generally coarse textured, deep, and have adequate moisture for plant growth during the growing season.

storms, and infrequent hurricanes. Insect disturbances are often caused by southern pine beetles.

Land Use. Natural vegetation has been cleared for agriculture on about 25 percent of the area. Much of the non-cleared land is managed for forestry.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Section 231F—Eastern Gulf Prairies and Marshes

Geomorphology. This Section is in the Coastal Plains geomorphic province. The predominant landform is a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation ranges from 10 to 330 ft (3 to 100 m). Local relief ranges from 0 to 100 ft (0 to 30 m).

Lithology and Stratigraphy. Rock units formed during the Cenozoic Era. Strata consist of Quaternary marine deposits (non-glacial sand, silt, and clay deposits of upland origin).

Soil Taxa. Aquolls, Sapristis, Aquents, and Hemists are the principal soils along the coast. Also along the coast are Aquolls, Haplaquolls, Medisapristis, Hydraquents, and Medihemists, all of which are poorly drained and subject to flooding and high water tables. These soils have a thermic temperature regime and an aquic moisture regime. Farther inland, Uderts and Aqualfs are the main soils, especially where saline prairie vegetation is present. Soils farther inland on low lands are Pelluderts, Pellusterts, Albaqualfs, Ochraqualfs, and Glossaqualfs. Situated on flood plains are Argiaquolls, Haplaquolls, and Haplaquepts. Soils have a thermic to hyperthermic moisture regime, and an aquic moisture regime. These soils are deep, clayey, poorly drained, and have subsoils that are slowly permeable.

Potential Natural Vegetation. Küchler classified vegetation as bluestem-sacahuista prairie and southern cordgrass prairie. Predominant vegetation is mid to tall grass grasslands. Species consist of little bluestem, indianguass, switchgrass, and big bluestem. Occasional areas of live oak are present. Poorly drained areas along the coast support freshwater and saltwater marsh vegetation of sedges, rushes, saltgrass, and cordgrass.

Fauna. Typical large herbivores and carnivores include manatee, coyote, red wolf, ringtail, ocelots, and river otter. Smaller herbivores include swamp rabbit, fulvous harvest mouse, eastern wood rat, and nutria. Common birds of freshwater marshes, lakes, ponds, and rivers include reddish egret, white-faced ibis, white-fronted goose, and olivaceous cormorant. Attwater's prairie chicken was once common in the grasslands. Reptiles and amphibians include American alligator, Gulf coast salt marsh snake, Gulf coast toad and pig frog, diamondback terrapin, Mediterranean gecko, and the Texas horned lizard.

Climate. Average annual precipitation is from 30 to 55 in (750 to 1,400 mm). Temperature averages 66 to 74 °F (19 to 23 °C). The growing season lasts 250 to 330 days.

Surface Water Characteristics. There is a moderate density of small to medium size perennial streams and very low density of associated rivers; most have a moderate volume of water at very low velocity. Water table is high in many areas, resulting in poor natural drainage and abundance of wetlands. Poorly defined drainage pattern has developed on this very young, weakly dissected plain. Abundance of palustrine systems having seasonally high water level. This Section adjoins the Louisianian Marine and Estuarine Province delineated by the USDI Fish and Wildlife Service.

Disturbance Regimes. Fire and ocean tides have likely been the principal historical disturbance. Climatic influences include occasional hurricanes.

Land Use. Natural vegetation has been cleared for agricultural crops on about 40 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southeastern Forest Experiment Station and Southern Region.

Section 231G—Arkansas Valley

Geomorphology. This Section is in the Ouachita geomorphic province. The area consists of a folded, faulted, and uplifted belt of parallel valleys and ridges, moderately dissected by differential erosion, mass wasting, fluvial erosion and transport and deposition. About 80 percent of this land consists of plains with hills and 20 percent includes open low mountains. Elevation ranges from 330 to 3,000 ft (100 to 900 m). Local relief ranges from 300 to 500 ft (90 to 150 m) in areas with hills. Relief is 500 to 1,000 ft (150 to 300 m) in areas with low mountains.

Lithology and Stratigraphy. Rocks units formed during the Paleozoic Era. Strata consist of Pennsylvanian marine deposits (sandstone, shale, coal, and limestone).

Potential Natural Vegetation. Kuchler mapped this area as oak-hickory-pine forest, southern mixed forest, and southern floodplain forest. The predominant vegetation form consists of needle-leaved evergreen trees. Belts of cold deciduous, broad leaved hardwoods are prevalent along rivers. The principal forest cover type is loblolly and longleaf pines. Where hardwoods are prevalent, species consist of post, white, blackjack, and southern red oaks. Species of bottom lands are red maple, green ash, Nuttall oak, sweetgum, and swamp hickory.

Fauna. The elk, mountain lion, wolf, Carolina parakeet, and ivory-billed woodpecker once inhabited this Section. Presently, the fauna include white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, striped skunk, swamp rabbit, and many small rodents and shrews. The turkey, bobwhite, and mourning dove are game birds in various parts of this Section. In flooded areas, ibises, cormorants, herons, egrets, and kingfishers are common. Songbirds include the

red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake and timber rattlesnake.

Climate. Annual precipitation averages 40 to 54 in (1,000 to 1,300 mm). Temperature averages 61 to 68 °F (16 to 20 °C). The growing season lasts about 200 to 270 days.

Surface Water Characteristics. There is a moderate density of small to medium size perennial streams and associated rivers, most with moderate volume of water flowing at low velocity. Dendritic drainage pattern has developed. Major rivers draining this Section include the Red and Ouachita.

Disturbance Regimes. Fire has probably been the principal historical disturbance. Climatic influences include occasional summer droughts and winter ice



Shortleaf pine, oak, and hickory forest on upland sites of the Davy Crockett National Forest in eastern Texas.

Soil Taxa. Soils are predominately Udults. Hapludults and Paleudults are on ridgetops and upper slopes, and are also on mid to lower slopes in concave positions. Fragiudults are in valleys. Soils along the Arkansas River include Udifluvents, Udipsamments, Haplaquolls, and Hapludalfs. Soils have a thermic temperature regime, a udic moisture regime, and siliceous or mixed mineralogy. Soils are variable in characteristics, ranging from shallow to deep, but most are well drained. Soil moisture is adequate for plant growth during most of the growing season.

Potential Natural Vegetation. K  chler mapped vegetation as oak-hickory forest, oak-hickory-pine forest, cross timbers (*Quercus-Andropogon*), and southern floodplains forest. The predominant vegetation form is about equal areas of cold-deciduous, broad-leaved forest and needle-leaved evergreen trees. Principal forest cover types are oak-hickory and loblolly-shortleaf pine. Species include white, black, bur, post, and blackjack oaks; pignut and mockernut hickories; and loblolly and shortleaf pines. Oak-gum-cypress forest type is dominant along major river bottoms and includes cottonwood, sugarberry, river birch, and green ash.

Fauna. Historically, the elk, Florida panther, bison, passenger pigeon, ivory-billed woodpecker, Carolina parakeet, and Bachman's warbler inhabited this Section. Presently the fauna include white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, striped skunk, swamp rabbit, and many small

rodents and shrews. In flooded areas, beavers, ibises, cormorants, herons, egrets, and kingfishers are common. Endemics include the Magazine Mountain shagreen, longnose darter, and Arkansas darter. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler and Carolina wren. The herpetofauna include the box turtle, common garter snake and timber rattlesnake.

Climate. Annual average precipitation is 44 to 50 in (1,120 to 1,270 mm). Average temperature is 61 to 63   F (16 to 17   C). The growing season lasts 200 to 240 days.

Surface Water Characteristics. This Section has a high density of small to medium size perennial streams and associated rivers; those in intermountain basins have moderate rates of flow and some on mountain sides are characterized by high rates of flow and velocity. A trellis drainage pattern has developed. One of the large rivers draining this Section is the Arkansas.

Disturbance Regimes. Reserved.

Land Use. Reserved.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Province 232–Outer Coastal Plain Mixed Forest

Seven Sections have been delineated in this Province: 232A–Middle Atlantic Coastal Plain; 232B–Coastal Plains and Flatwoods, Lower; 232C–Atlantic Coastal Flatlands; 232D–Florida Coastal Lowlands (Western); 232E–Louisiana Coast Prairies and Marshes; 232F–Coastal Plains and Flatwoods, Western Gulf; and 232G–Florida Coastal Lowlands (Eastern). These Sections are located in the southeastern conterminous States, including parts of Delaware, Maryland, Virginia, North and South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. The area of these Section is about 173,800 mi² (450,100 km²).

Section 232A–Middle Atlantic Coastal Plain

Geomorphology. This Section is in the Coastal Plains geomorphic Province. The predominant landform consists of a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore zone processes are active in developing and maintaining beaches, swamps, and mud flats. Landforms on about 50 percent of this Section consists of flat plains. Much of the other landforms are irregular plains. Elevation ranges from 0 to 80 ft (0 to 25 m). Local relief ranges from 10 to 20 ft (3 to 6 m) on flat plains and from 20 to 40 ft (6 to 12 m) on the irregular plains.

Lithology and Stratigraphy. Rocks in this Section formed during the Cenozoic Era. Strata consist of Quaternary marine deposits (shales and sands). Small areas of Tertiary marine deposits (silts and clays) are exposed along some larger rivers.

Soil Taxa. Soils consist of Udults in the northern part. Hapludults are common in areas with and without loess. Quartzipsamments are on high ridges. Hydraquents are in tidal marshes next to the Chesapeake Bay. These soils are deep and have inadequate to excessive moisture contents. Their temperature regime is mesic and moisture regime is udic. These soils are deep, adequately drained, and have adequate soil moisture supply for use by vegetation during the growing season.

In the middle coastal zones are Aquults and Aqualfs soils. Umbraquults, Ochraqualfs, and Albaqualfs are common. Hapludults are on higher areas. Haplaquods and Udipsamments are also common. Paleaquults and Umbraquults are on wetter inland sites. Other common soils include Hapludults, Paleults, Haplaquods, and Quartzipsamments. These soils have a thermic temperature regime, a udic moisture regime, and mixed or siliceous mineralogy. Soils are deep, fine textured, and have adequate to excessive moisture supply for vegetation during the growing season.

Potential Natural Vegetation. Küchler classified vegetation as oak-hickory-pine forest and southern floodplain forest. The predominant vegetation form is needle-leaved evergreen forest and smaller areas of cold-deciduous broad-leaved forests. The main forest cover type is loblolly pine-hardwood, where hardwood species consist of sweetgum, water oak, white ash, yellow-poplar, red maple, and swamp hickory. On bottomland areas along major rivers, species include green ash, sugarberry, water oak, American sycamore, sweetgum, and American elm.

Fauna. The elk, mountain lion, wolf, Carolina parakeet, and ivory-billed woodpecker once inhabited this Section. Presently, the fauna include white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, striped skunk, swamp rabbit, and many small rodents and shrews. The turkey, bobwhite, and mourning dove are game birds in various parts of this Section. In flooded areas, ibises, cormorants, herons, egrets, and kingfishers are common. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake, and timber rattlesnake. Fauna generally found in the sandy ridges in this Section are eastern indigo snake and gopher tortoise. Fauna generally found in the mature pine lands are the red-cockaded woodpecker and the pine warbler.

Climate. Precipitation averages 46 in (1,100 mm). Average annual temperature is 55 to 57 °F (13 to 14 °C). The growing season lasts 185 to 220 days.

Surface Water Characteristics. This area has a moderate density of small to medium size perennial streams and a low density of associated rivers, most with moderate volume of water flowing at very low velocity. Water table is high in many areas, resulting in poor natural drainage and abundance of wetlands. A poorly defined drainage pattern has developed on this relatively young plain. There are numerous palustrine systems having seasonally high water levels, especially in pocosin areas. Major rivers draining this Section include the James and Potomac.

Disturbance Regimes. Reserved.

Land Use. Natural vegetation has been cleared for agriculture on about 65 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southeastern Forest Experiment Station and Southern Region.

Section 232B—Coastal Plains and Flatwoods, Lower

Geomorphology. This Section is in the Coastal Plain geomorphic Province. The predominant landform is a flat, weakly dissected alluvial plain was formed by deposition of continental sediments onto a submerged, shallow continental shelf, which was later exposed by sea level subsidence. About 90 percent of this Section consists of irregular or smooth plains. Other landforms include open hills. Elevation ranges from 80 to 660 ft (25 to 200 m). Local relief ranges from 10 to 30 ft (3 to 9 m) on smooth plains, and from 30 to 50 ft (9 to 15 m) in areas of hills.

Lithology and Stratigraphy. Rock units formed during the Mesozoic (30 percent) and Cenozoic (70 percent) Eras. Mesozoic strata consist of about equal amounts of Cretaceous marine deposits (sands and clays). Much of the Cenozoic strata consist of Tertiary marine deposits (thin fossiliferous layers of sand and shells) and continental deposits (sands and clays). Quaternary marine deposits (coarse sands) are present in large bays.

Soil Taxa. Soils are mostly Udults. Paleudults and Hapludults are on uplands. Fragiudults and Fragiudalfs are associated soils on sites that range from well drained to poorly drained. Localized areas of Quartzipsamments occur in the southern part of the Section, along with Paleudalfs and Glossaqualfs. Ochraqults, Albaquults, and Paleaquults are locally common on low wetlands. Udi fluvents, Fluvaquents, and Dystrochrepts are present



The flat terrain of south Georgia and north Florida is dominated by slash pine forests with a shrub layer of evergreen saw palmetto and gallberry.



Lakes are numerous in central Florida, where much of the natural vegetation of oaks, pines, and wiregrass has been cleared for citrus production and urban development.

in bottom lands. These soils have a thermic temperature regime, an udic moisture regime, and are deep with loamy or clayey subsoil. Soils range from well drained to poorly drained and are fine to moderately fine textured.

Potential Natural Vegetation. K  chler mapped this area as southern mixed forest and oak-hickory-pine forest, with smaller areas of southern flood plain forest and pocosin (*Pinus-Illex*). The predominant vegetation form is evergreen needle-leaved trees with scattered areas of cold-deciduous and evergreen broad-leaved forest. Slash and longleaf pines are prevalent throughout the Section, but loblolly pine is common in the northern areas. Sand pine is prevalent in xeric, deep-sand areas of Florida. The oak-gum-cypress forest cover type is common along flood plains of major rivers and includes Nuttall oak, laurel oak, water tupelo, sweetbay, bald cypress, and pond cypress. Localized areas of mostly hardwoods occur, especially in central Florida; types include laurel oak, water oak, sweetbay, sweetgum, live oak, red maple, and spruce pine. An extensive area of grassland vegetation is present in central Florida, north of Lake Okeechobee.

Fauna. The elk, mountain lion, wolf, Carolina parakeet, and ivory-billed woodpecker once inhabited this Section. The endangered Florida panther may be encountered rarely. Presently, the fauna include white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, striped skunk, swamp rabbit, and many small rodents and shrews. The turkey, bobwhite, and mourning dove are widespread. Resident and migratory nongame bird species are numerous, as are species of migratory waterfowl. In flooded areas, ibises, cormorants, herons, egrets, and kingfishers are common. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, ruby-throated hummingbird, eastern towhee, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The endangered red-cockaded woodpecker and bald eagle inhabit this Section. The herpetofauna include the box turtle, common garter snake, eastern diamondback rattlesnake, timber rattlesnake and American alligator.

Climate. Precipitation averages 40 to 60 in (1,020 to 1,520 mm). Temperature averages 60 to 68   F (16 to 20   C). The growing season lasts 200 to 280 days.

Surface Water Characteristics. There is a moderate density of small to medium size perennial streams and associated rivers, most with moderate volume of water flowing at low velocity. Few natural lakes occur, except in central Florida where they are abundant. Large, freshwater springs are common in central Florida, especially in areas of limestone rock formations. Major rivers include the Mobile, Chattahoochee, Kissimmee, Flint, and Savannah. Riverine systems flow into the Carolinian and Louisianian Marine and Estuarine Provinces.

Disturbance Regimes. Fire has been the principal historical disturbance, previously burning over medium to large size areas between natural barriers, generally with moderate frequency and low intensity. Fire occurrence is common in areas dominated by sand pine and is frequent in areas of longleaf pine. Fire intensity can range from moderate to high. Climatic influences include frequent hurricanes. Insect disturbances are often caused by southern pine beetles.

Land Use. Natural vegetation has been cleared for agriculture on about 40 percent of the area in much of the Section. In much of central Florida, almost all forests have been cleared for citrus production.

Cultural Ecology. Reserved.

Compiled By. Southern Region and Southeastern Forest Experiment Station.

Section 232C–Atlantic Coastal Flatlands

Geomorphology. This Section is in the Coastal Plains geomorphic province. The predominant landform is a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation ranges from 0 to 80 ft (0 to 25 m). Local relief ranges from 0 to 25 ft (0 to 8m).

Lithology and Stratigraphy. Rock units formed during the Cenozoic Era. Strata consist of Tertiary marine deposits, thin formations of shale and sand. Quaternary marine deposits consist of sand, silt, and clay alluvial deposits of upland origin.

Soil Taxa. The most extensive soils are Aquults. Paleaquults and Umbraquults are on lower, wetter areas. Hapludults and Paleudults are on higher areas with better drainage. Also locally important are Haplaquods, Quartzipsammments, and Paleudults. Histosols are dominant in the Okefenokee Swamp of Georgia and the Dismal Swamp of Virginia. Soils in this Section have a thermic temperature regime and an aquic moisture regime. Soils are deep, medium textured, and have adequate to excessive water supplies for use by vegetation.

Potential Natural Vegetation. K  chler classified vegetation as mainly southern mixed forest and oak-hickory-pine forest, with smaller areas of southern flood plain forest and pocosin (*Pinus-Illex*). The predominant vegetation form is needle-leaved evergreen forest with smaller areas of evergreen broad leaved forest. Forest cover type is mainly longleaf pine and slash pine in the northern areas. In the southern areas, slash pine replaces loblolly. Pond pine, a fire-maintained species with serotinous cones, is prevalent in coastal North Carolina, where poorly drained organic soils are present and wildfire



Longleaf pine-savanna community on the Croatan National Forest in eastern North Carolina.

is common. The oak-gum-cypress forest type is common along flood plains and major rivers; it includes water oak, laurel oak, swamp tupelo, sweetbay, bald cypress, and pond cypress. Localized areas of mostly hardwoods occur and include laurel oak, water oak, sweetbay, sweetgum, live oak, red maple, and spruce pine.

Fauna. The elk, mountain lion, wolf, Carolina parakeet, and ivory-billed woodpecker once inhabited this Section. The endangered Florida panther may be encountered rarely. Presently, the fauna include white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, striped skunk, swamp rabbit, and many small rodents and shrews. The presence of turkey, bobwhite, and mourning dove is widespread. Resident and migratory nongame bird species are numerous, as are species of migratory waterfowl. In flooded areas, ibises, cormorants, herons, egrets, and kingfishers are common. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, ruby-throated hummingbird, eastern towhee, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The endangered red-cockaded woodpecker and bald eagle inhabit this Section. The herpetofauna include the box turtle, common garter snake, eastern diamondback rattlesnake, timber rattlesnake, and American alligator.

Climate. Annual precipitation averages about 46 in (1,170 mm). Temperature averages 55 to 57 °F (13 to 14 °C). The growing season lasts 185 to 220 days.

Surface Water Characteristics. This Section has a moderate density of small to medium size perennial streams and a low density of associated rivers, most with moderate volume of water at very low velocity. Water table is high in many areas, resulting in poor natural drainage and abundance of wetlands. Poorly defined drainage pattern has developed on this relatively young, weakly dissected plain. There are numerous palustrine systems with seasonally high water levels, especially in pocosin areas. Carolina Bays form natural lakes in some areas. Major rivers include the St. John, Altamaha, Santee, Pee Dee, and Neuse.

Disturbance Regimes. Fire has probably been the principal historical disturbance; high intensity fires are relatively common in the pocosin area of eastern North Carolina. Climatic influences include frequent hurricanes. Insect disturbances are often caused by southern pine beetles.

Land Use. Natural vegetation has been cleared for agriculture on about 40 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Section 232D—Florida Coastal Lowlands (Western)

Geomorphology. This Section is in the Coastal Plains geomorphic province. The predominant landform is a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation ranges from 0 to 80 ft (0 to 25 m). Local relief ranges from 0 to 100 ft (0 to 30 m).

Lithology and Stratigraphy. Rock units formed during the Cenozoic Era. About 50 percent of the strata consist of Tertiary marine deposits (limestone interbedded with marl, sand, and clay). Quaternary marine deposits of terrestrial origin (nonglacial sand, silt, and clay) make up the other strata.

Soil Taxa. Dominant soils are Aquults, Aquepts, Aquods, and Aquepts. A complex of Paleaquults, Haplaquods, Quartzipsamments, and Sulfaquents occurs throughout the Section. Many locations near the coast are very poorly drained Sulfaquents, Sulfishemists, and Hydraquents. Other coastal areas consist of excessively drained Quartzipsamments on old beach ridges and dunes. Soils have thermic and hyperthermic temperature regimes and an aquic moisture regime. Generally, soils are poorly drained, deep, and moderately textured.

Potential Natural Vegetation. Küchler classified vegetation as oak-hickory-pine forest, southern flood plain forest, and live oak-sea oats. The predominant vegetation form is evergreen needle-leaved forest and evergreen broad-leaved forest. The main forest cover type is longleaf pine and slash pine. Large areas of oak-gum-cypress cover type are present in the central part of the Section along major river bottoms, with species of water oak, laurel oak, swamp tupelo, sweetbay, bald cypress, and pond cypress.

Fauna. The elk, mountain lion, wolf, Carolina parakeet, and ivory-billed woodpecker once inhabited this Section. Presently, the fauna include white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, striped skunk, swamp rabbit, and many small rodents and shrews. The presence of turkey, bobwhite, and mourning dove is widespread. Resident and migratory nongame bird species are numerous, as are species of migratory waterfowl. In flooded areas, ibises, cormorants, herons, egrets, and kingfishers are common. Songbirds include the cardinal, pine warbler, ruby-throated hummingbird, eastern towhee, summer tanager, hooded warbler, and Carolina wren. The endangered red-cockaded woodpecker and bald eagle inhabit this Section. The herpetofauna include the box turtle, common garter snake, eastern diamondback rattlesnake, timber rattlesnake, and American alligator.



Towering longleaf pine over wiregrass on the Apalachicola National Forest. Wiregrass response is at its greatest when burned regularly in the growing season.

Climate. Average annual precipitation is 52 to 64 in (1,300 to 1,600 mm). Average annual temperature is 66 to 70 °F (19 to 21 °C). The growing season lasts 270 to 290 days.

Surface Water Characteristics. There is a moderate density of small to medium size perennial streams and very low density of associated rivers, most with moderate volume of water at very low velocity. Water table is high in many areas, resulting in poor natural drainage and abundance of wetlands. Numerous palustrine systems are present, most with a seasonally high water level. Major rivers include the Peace, Hillsborough, Withlacoochee, and Apalachicola. This Section adjoins the Carolinian and Louisianian Marine and Estuarine Provinces delineated by the USDI Fish and Wildlife Service.

Disturbance Regimes. Reserved.

Land Use. Natural vegetation has been cleared for agriculture on about 65 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Section 232E—Louisiana Coast Prairies and Marshes

Geomorphology. This Section is in the Coastal Plains geomorphic Province. The predominant landform is a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore-zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation ranges from 0 to 160 ft (0 to 50 m). Local relief ranges from 0 to 50 ft (0 to 15 m).

Lithology and Stratigraphy. Rock units formed during the Cenozoic Era. Strata consist of Quaternary marine deposits of terrestrial origin, non glacial sand, silt, and clay.

Soil Taxa. Aquolls, Sapristis, Aquents, and Hemists are the principal soils along the coast. Also along the coast are Aquolls, Haplaquolls, Medisapristis, Hydraquents, and Medihemists, all of which are poorly drained and subject to flooding and high water tables. These soils have a thermic temperature regime and an aquic moisture regime.

Potential Natural Vegetation. Küchler classified vegetation as bluestem-sacahuista prairie and southern cordgrass prairie. Much of the existing vegetation is nonforested grasslands. Prairie grasslands dominate areas inland from the coast and consist of little bluestem, indianguass, switchgrass, and big bluestem. Occasional areas of live oak are present. Poorly drained areas along the coast support freshwater and saltwater marsh vegetation of sedges, rushes, saltgrass, and cordgrass.

Fauna. Large herbivores and carnivores include manatee, coyote, red wolf, ringtail, and river otter. Ocelots were once common, but are now rare. Smaller herbivores include swamp rabbit, fulvous harvest mouse, eastern wood rat, and nutria. Birds of fresh water marshes, lakes, ponds, and rivers include reddish egret, white-faced ibis, white-fronted goose, and olivaceous cormorant. Birds of grasslands include Attwater's prairie chicken. Reptiles and amphibians include the Gulf coast salt marsh snake, Gulf coast toad, pig frog, American Alligator, diamondback terrapin, Mediterranean gecko, and Texas horned lizard.

Climate. Annual precipitation averages 25 to 55 in (620 to 1,400 mm). Temperature averages 68 to 70 °F (20 to 21 °C). The growing season lasts 280 to 320 days.

Surface Water Characteristics. There is a moderate density of small to medium size perennial streams and very low density of associated rivers, most with moderate volume of water at very low velocity. Water table is high in many areas, resulting in poor natural drainage and an abundance of wetlands. The Mississippi River flows

through this Section into the Gulf of Mexico. Palustrine systems are abundant and have seasonally high water levels. This Section adjoins the Louisianian Marine and Estuarine Province delineated by the USDI Fish and Wildlife Service.

Disturbance Regimes. Fire and ocean tides have probably been the principal historical disturbance. Climatic influences include occasional hurricanes.

Land Use. Natural vegetation has been converted to agricultural crops on about 40 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southeastern Forest Experiment Station and Southern Region.

Section 232F—Coastal Plains and Flatwoods, Western Gulf

Geomorphology. This Section is in the Coastal Plains geomorphic province. The predominant landform consists of weakly to moderately dissected irregular plains of alluvial origin formed by deposition of continental sediments onto a submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore zone processes are active in developing and maintaining beaches, swamps, and mud flats. About 80 percent of this Section consists of irregular plains. Other landforms include flat plains and plains with hills. Elevation ranges from 80 to 660 ft (25 to 200 m). Local relief mostly ranges from 100 to 300 ft (30 to 90 m) on irregular plains; however, relief ranges from 0 to 100 ft (0 to 30 m) on flat plains and 300 to 500 ft (90 to 150 m) where plains with hills are present.

Lithology and Stratigraphy. Rocks in this Section formed during the Cenozoic Era. About 80 percent of the geologic strata consist of Tertiary marine deposits, including glauconitic, calcareous, fossiliferous strata with lignitic sandy and argillaceous contents. Quaternary marine deposits are present along the Red River.

Soil Taxa. Soils are mostly Udults. Paleudults, Hapludults, Hapludalfs, Paleudalfs, and Albaqualfs are on uplands. Fluvaquents, Udifluvents, Eutrochrepts, and Glossaqualfs are along major streams. Soils are mostly derived from weathered sandstone and shale. Soils have a thermic temperature regime, a udic moisture regime, and siliceous or mixed mineralogy. Soils are deep, coarsely textured, mostly well drained, and have an adequate supply of moisture for use by vegetation during the growing season.

Potential Natural Vegetation. Küchler mapped vegetation as southern mixed forest, oak-hickory-pine forest, and southern flood plain forest. The predominant vegetation form is evergreen needle-leaved forest with a small area of cold-deciduous alluvial forest. The slash pine and longleaf pine cover type dominates most of

the Section. The loblolly pine-shortleaf pine cover type is common in the northern parts of the Section. A bottomland type is prevalent along most major rivers and consists of cottonwood, sycamore, sugarberry, hackberry, silver maple, and red maple.

Fauna. The elk, mountain lion, wolf, Carolina parakeet, and ivory-billed woodpecker once inhabited this Section. The endangered Florida panther may be encountered rarely. Presently, the fauna include white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, striped skunk, swamp rabbit, and many small rodents and shrews. The presence of turkey, bobwhite, and mourning dove is widespread. Resident and migratory nongame bird species are numerous, as are species of migratory waterfowl. In flooded areas, ibises, cormorants, herons, egrets, and kingfishers are common. Songbirds include the red-eyed

vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The endangered red-cockaded woodpecker and bald eagle inhabit this Section. The herpetofauna include the box turtle, common garter snake, eastern diamondback rattlesnake, timber rattlesnake, and American alligator.

Climate. Precipitation averages 40 to 54 in (1,020 to 1,350 mm) annually. Annual temperature averages 61 to 68 °F (16 to 20 °C). The growing season lasts 200 to 270 days.

Surface Water Characteristics. This Section has a moderate density of small to medium size perennial streams and associated rivers. Dendritic drainage pattern has developed without bedrock structural control. Major rivers include the Sabine, Red, and Mississippi.

Disturbance Regimes. Fire has probably been the principal historical disturbance. Climatic influences include occasional summer droughts and winter ice storms and infrequent hurricanes. Insect disturbances are often caused by southern pine beetles.

Land Use. Natural vegetation has been cleared for agriculture on about 60 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Section 232G—Florida Coastal Lowlands (Eastern)

Geomorphology. This Section is in the Coastal Plains geomorphic Province. The predominant landform is a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation averages 52 to 64 in (1,300 to 1,600 mm). There is little local relief.

Lithology and Stratigraphy. Rock units formed during the Cenozoic Era. About 50 percent of the strata consist of Tertiary marine deposits, limestone interbedded with marl, sand, and clay. Quaternary marine deposits make up the other strata and include sand, silt, and clay.

Soil Taxa. Dominant soils are Aquults, Aquepts, Aquods, and Aquepts. A complex of Paleaquults, Haplaquods, Quartzipsamments, and Sulfaquents occurs throughout the Section. Many locations near the coast are very poorly drained Sulfaquents, Sulfihemists, and Hydraquents. Other coastal areas consist of excessively drained Quartzipsamments on old beach ridges and dunes.



Characteristic upland longleaf pine landscape in the Coastal Plains and Flatwoods, Western Gulf Section on the Kisatchie National Forest.

Soils have thermic and hyperthermic temperature regimes and an aquic moisture regime. Generally, soils are poorly drained, deep, and moderately textured.

Potential Natural Vegetation. Kuchler classified vegetation as oak-hickory-pine forest, southern flood plain forest, and live oak-sea oats. The predominant vegetation form is evergreen needle-leaved forest and evergreen broad-leaved forest. The main forest cover type is longleaf pine and slash pine. Large areas of oak-gum-cypress cover type are present in the central part of the Section along major river flood plains, with species of water oak, laurel oak, swamp tupelo, sweetbay, bald cypress, and pond cypress.

Fauna. The elk, mountain lion, wolf, Carolina parakeet, and ivory-billed woodpecker once inhabited this Section. Presently, the fauna include white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, striped skunk, swamp rabbit, and many small rodents and shrews. The presence of turkey, bobwhite, and mourning dove is widespread. Resident and migratory nongame bird species are numerous, as are species of migratory waterfowl. In flooded areas, ibises, cormorants, herons, egrets, and kingfishers are common. Songbirds include the cardinal, pine warbler, ruby-throated hummingbird, eastern towhee, summer tanager, hooded warbler, and Carolina wren. The endangered red-cockaded woodpecker and bald eagle inhabit this Section. The herpetofauna include the box turtle, common garter snake, eastern diamondback rattlesnake, timber rattlesnake, and American alligator.

Climate. Precipitation averages 52 to 64 in (1,300 to 1,600 mm). Annual temperature ranges from 66 to 70 °F (19 to 21 °C). The growing season lasts 270 to 290 days.

Surface Water Characteristics. This Section has a low density of small to medium size perennial streams and very low density of associated rivers, most with moderate volume of water at very low velocity. Water table is high in many areas, resulting in poor natural drainage and abundance of wetlands. Poorly defined drainage pattern has developed on very young alluvial plains. An abundance of palustrine systems is present; and they have seasonally high water levels. One of the major rivers is the St. John. This Section adjoins the Carolinian and Louisianian Marine and Estuarine Provinces as delineated by the USDI Fish and Wildlife Service.

Disturbance Regimes. Reserved.

Land Use. Commercial forestry is practiced on about half of the land area; urban development utilizes the remainder.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Province 234—Lower Mississippi Riverine Forest

One Section has been delineated in this Province: 234A—Mississippi Alluvial Basin. This Section is located in the south-central conterminous States, including parts of Missouri, Arkansas, Tennessee, Mississippi, and Louisiana. The area of this Section is about 44,300 mi² (114,700 km²).

Section 234A—Mississippi Alluvial Basin

Geomorphology. This Section is in the Coastal Plains geomorphic province. The predominant landform consists of flat, weakly to moderately dissected alluvial plains. The plains were formed by deposition of continental sediments into a submerged, synclinal trough, which was later exposed by sea level subsidence. Elevation ranges from 0 to 660 ft (0 to 200 m). Local relief in most of the Section ranges from 0 to 100 ft (0 to 30 m), but it can range from 100 to 300 ft (30 to 90 m), such along bluffs of bordering the Mississippi River.

Lithology and Stratigraphy. Rock units formed during the Cenozoic Era. About 20 percent consists of Tertiary marine deposits (lignitic sandy and argillaceous deposits). The remainder consists of about equal amounts of Quaternary marine deposits of glacial outwash. Recent alluvium consists of silt deposited during floods.

Soil Taxa. Soils are Aquepts, Aqualfs, Aquepts, Udolls, and Udalfs. Haplaquepts, Ochraqualfs, Fluvaquepts, Natraqualfs, Ochraqualfs, and Hapludalfs are found in back-swamp areas and older natural levees. Dystrochrepts, Udifluvents, and Fluvaquepts occur in smaller areas. Hydraquepts and Medisaprists are in southern Louisiana. These soils have a udic or aquic moisture regime, a thermic temperature regime, and montmorillonitic or mixed mineralogy. Soils, which formed in alluvium, are deep, medium textured, and have adequate or excessive moisture available for vegetation during the growing season.



Much of this Section, in the Kisatchie National Forest, is characterized by alluvial soils that provide suitable habitat for forest species of swamp tupelo, water oak, and cypress—as indicated by the “knees” in the foreground.

Potential Natural Vegetation. Küchler classified vegetation as southern flood plain forest and oak-hickory forest. The predominant vegetation form is cold deciduous, alluvial broadleaf forest, with small areas of cold-deciduous, broad-leaved forest on upland sites. The main cover type is oak-gum-cypress, where main species are Nuttall oak, water oak, laurel oak, cherrybark oak, cottonwood, sycamore, hackberry, red and silver maple, and bald cypress. The oak-hickory cover type consists of post oak, bur oak, northern red oak, black oak, and white oak.

Fauna. The elk, mountain lion, wolf, Carolina parakeet, and ivory-billed woodpecker once inhabited this Section. Presently, the fauna include white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, striped skunk, swamp rabbit, and many small rodents and shrews. The turkey, bobwhite, and mourning dove are game birds in various parts of this Section. In flooded areas, ibises, cormorants, herons, egrets, and kingfishers are common. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake, and timber rattlesnake.

Climate. Precipitation averages 45 to 65 in (1,150 to 1,650 mm) annually. Temperature averages 56 to 70 °F. (14 to 21 °C). The growing season lasts 200 to 340 days.

Surface Water Characteristics. This Section includes the lower part of the Mississippi River from its confluence with the Ohio River. The drainage pattern is varied, ranging from dendritic to trellis, and has developed without bedrock structural control. The principal river draining this and adjoining Sections is the Mississippi. The Red River enters the Mississippi near the southern edge of this Section. Many oxbow-type natural lakes have formed along the Mississippi River.

Disturbance Regimes. Periodic flooding has been the principal historical disturbance, but has been reduced by a series of levees and dams build for flood control.

Land Use. Natural vegetation has been cleared for agriculture on about 90 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Province M231—Ouachita Mixed Forest - Meadow

One Section has been delineated in this Province: M231A—Ouachita Mountains. This Section is located in Arkansas and Oklahoma. The area is about 8,800 mi² (22,800 km²).

Section M231A—Ouachita Mountains

Geomorphology. This section is in the Ouachita geomorphic province. It was formed by tectonic faulting and uplift of resistant bedrock into a narrow band of metamorphosed, parallel (east-west trending) mountain ranges. This was followed by mass wasting and steep and gentle stream valley erosion with fluvial transport. About 75 percent of the area consists of open high hills. Also included are open low mountains. Elevation ranges from 330 to 2,600 ft (100 to 800 m). Local relief in much of the section ranges from 500 to 800 ft, but it can range from 1,000 to 2,000 ft in areas with low mountains.

Lithology and Stratigraphy. Rocks formed during the Paleozoic (50 percent), Mesozoic (40 percent), and Cenozoic (10 percent) Eras. Paleozoic strata consist of: Cambrian marine deposits (carbonates and shales); Ordovician marine deposits (carbonates, shales, and limestones); Mississippian marine deposits (sandstone); and Pennsylvanian marine deposits (sandstone). Mesozoic strata consist of Lower and Upper Cretaceous marine deposits (limestone). Cenozoic strata consist of Quaternary marine deposits.

Soil Taxa. Soils are mainly Udults. Hapludults are at higher elevations on steep slopes, gentle slopes of ridgetops, and foot slopes. Dystrichrepts and Ochraquults are on flood plains. Some localized areas of Hapludults are on terraces in the valleys. These soils have a thermic temperature regime, a udic moisture regime, and siliceous or mixed mineralogy. Soils are generally deep, often stony, and have adequate moisture for use by vegetation during the growing season.



Caney Creek Wilderness in the Ouachita Mountains Section of the Ouachita National Forest.

Potential Natural Vegetation. Küchler classified vegetation as oak-hickory-pine forest. Existing forest types are mainly loblolly-shortleaf pine. The predominant vegetation form is evergreen needle-leaved forest and a small area of cold deciduous, broad-leaved forest. Loblolly pine and shortleaf pine cover types occur widely. Lesser areas of a shortleaf-oak type (southern red, scarlet, black, post, and blackjack oaks) and oak-hickory (black, scarlet, post, and white oaks and pignut and mockernut hickories) occur in Oklahoma.

Fauna. Among the fauna in this Section are white-tailed deer, black bear, bobcat, gray fox, raccoon, gray squirrel, fox squirrel, eastern chipmunk, white-footed mouse, pine vole, short-tailed shrew, and cotton mouse. The turkey, ruffed grouse, bobwhite, and mourning dove are game birds in various parts of this Section. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake, and timber rattlesnake. Endemics are Fourche Mountain salamander, Caddo Mountain salamander, Rich Mountain salamander, Ouachita madtom, Ouachita Mountain shiner, Kiamichi shiner, Ouachita darter, peppered shiner, and Rich Mountain slitmouth snail. Threatened and endangered species include the red-cockaded woodpecker, bald eagle, American burying beetle, Arkansas fatmucket, and rock pocketbook mussel. Other characteristic species include

the Western diamondback rattlesnake and eastern collared lizard.

Climate. Average precipitation is 48 to 56 in (1,220 to 1,420 mm). Mean annual temperature is 61 to 63 °F (16 to 17 °C). The growing season lasts 200 to 240 days

Surface Water Characteristics. There is a high density of small to medium size perennial streams and associated rivers; those in intermountain basins have moderate rates of flow, and some on mountain sides are characterized by high rates of flow and velocity. A trellis drainage pattern has developed, largely with bedrock structural control. Major rivers include the Fourche and Dutch Creek, which flow into the Arkansas River.

Disturbance Regimes. Fire has probably been the principal historical disturbance. Climatic influences include occasional summer droughts, winter ice storms, and infrequent tornados. Insect disturbances are often caused by southern pine beetles.

Land Use. Natural vegetation has been cleared for agriculture on about 25 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Province 242–Pacific Lowland Mixed Forest

One Section has been delineated in this Province: 242A–Willamette Valley and Puget Trough. The area of this Section, which is located in Washington and Oregon, is about 14,900 mi² (38,600 km²).

Section 242A–Willamette Valley and Puget Trough

Geomorphology. To the south, there are primarily cyclic flood deposits. These were laid down during the Spokane flood events, forming the smooth floor of the Willamette basin. Below the flood veneer, fluvial channel deposits and overbank clays interfinger with fans from the foothills. Studies of geomorphic surfaces with age and relationships clearly defined are described throughout the Willamette Valley. To the north, Pleistocene glaciers have deposited and eroded morainal debris. Generally, the glaciation produced predominately ground moraine to the north and outwash plains to the south of Tacoma. South of the glacial limit, a zone of branching drainages and low divides is sculpted in soft rocks. Throughout the Section, isolated basalt-capped mesas and islands of bedrock occur. Elevation ranges from sea level to 2,000 ft (700 m).



Rye grass seed production on the Eola geomorphic surface typical of the Willamette Valley foothills and uplands.

Lithology and Stratigraphy. The southern trough's basement is Eocene basalts and pyroclastics. To the north, sedimentary rocks are also found. These are overlain by up to 2,000 ft (610 m) of river-deposited sands, silt, and clay with basalt interbeds. Of these river deposits, the upper two to 100 ft (31 m) may be flood-deposited silts. To the north, the chaotic nature of glacial deposition and re-working is evident. Below the glacial features and exposed to the south of deposition, Miocene and pre-Miocene volcanics are overlain by Tertiary continental and marine deposits. In the far north, the San Juan Islands expose a Cenozoic mountain root complex.

Soil Taxa. Soils in this Section are characterized by a mesic temperature regime and xeric moisture regime. On the floor of the Willamette Valley, soils formed in the Willamette silts, which were deposited by the great Pleistocene Missoula floods, and in alluvium from Coast Range and Cascade Mountain drainages. Soil development, texture, and drainage are specific to geomorphic surfaces expressed in the valley. The youngest soils, on flood plains represented by the Ingram and Horseshoe surfaces, are well drained to excessively well drained, coarse textured, and have dark, base-rich surface horizons (Fluventic Haploxerolls and Cummulic Ultic Haploxerolls). On the Winkle surface are well drained and moderately well drained soils with clay-enriched subsoils and thick, dark, base-rich surface horizons (Pachic Ultic Argixerolls). The Champoege and Senacal surfaces are represented by silty, somewhat poorly drained soils with medium base saturation (Aquultic Argixerolls). Poorly drained, fine textured soils with light-colored surface horizons are on the Calapooyia surface (Typic Albaqualfs and Typic Endoqualfs). On forested foothills and uplands, south of the terminus of continental glaciation, well weathered soils have developed on old erosional surfaces (Eola and Dolph surfaces in the Willamette Valley). These well developed soils have clay-enriched subsoils and dark, organic matter-rich topsoils that are low in base cations (Xeric Palehumults and Haplohumults, and Ultic Palexeralfs and Haploxeralfs). Soils on upland terraces, formed in early to mid-Pleistocene alluvium, have mostly base-rich dark topsoil and are well drained to poorly drained (Ultic Argixerolls, Mollic Haploxeralfs and Fragixeralfs, Aquic Haploxerolls, and Typic Fragiumbrepts). In the Puget lowlands and foothills bounding the lowlands, soils have formed in and on drift deposited by continental glaciation. Soils are related to a complex mosaic of deposits resulting from glacial processes. Soils with a silica-cemented hardpan that impedes drainage and root penetration (Dystric Entic Durochrepts and Entic Durixerolls) occur on gravelly till deposits. Excessively drained, coarse textured soils with low water-holding capacity (Dystric Xerochrepts, Typic Haploorthods, and Dystric Xeropsamments) occur in sandy and gravelly outwash deposits. Fine textured, poorly

drained soils (Typic Endoaquolls, Aquic Palexeralfs, and Aquic Xerochrepts) occur in silty and clayey lake and marine deposits. On the floor of depressions in the glacial drift, soils are poorly drained and have accumulations of organic matter (Typic Medihemists and Humaquepts).

Potential Natural Vegetation. According to Kuchler, the Willamette Valley portion is a mosaic of two types, the cedar-hemlock-Douglas-fir and the Oregon oak woods forests. The Puget Trough portion is the cedar-hemlock-Douglas-fir forest. There is an area of the alder-ash forest along the Columbia River. Long-term human settlement has had pronounced influence on this area. More recent investigations suggest somewhat different interpretations of potential vegetation. The Willamette Valley portion is a mixture of Douglas-fir and White Oak series with local areas of Western Hemlock and Western Red Cedar series on more moist sites. A similar pattern occurs in the Puget Trough portion, but with a greater abundance of Western Hemlock and Western Red Cedar series and less amount of White Oak and Douglas-fir series. Riparian areas, with aquatic conditions, include Cottonwood, Willow, Ash, and Alder series. Bigleaf maple occupies mixed sites. Prairies of Idaho fescue are on droughty, gravelly soils in the Puget Trough; in the Willamette Valley, grasslands of danthonia, bentgrass, orchard grass, needle grass, fescue, and prairie June grass are on the drier sites. Tufted hairgrass and shrub thickets are dominant in wetlands.

Fauna. Blacktail deer commonly inhabit the area from the urban-farmland interface to the conifer forested uplands. Elk are frequent along the forest-bottomland interface but not common. Red fox, tree fox, opossum, nutria, beaver, and striped skunk are common valley inhabitants. Red-tailed hawk, Cooper's hawk, sharp-shinned hawk, and kestrel are common avian predators during summer; the major valley bottoms serve as winter grounds for rough-legged, red-tailed and Swainson's hawks. Great blue heron, osprey, and kingfisher are aquatic-associated species, as are the mallard, wood duck, green winged teal, hooded merganser, and common merganser. Canada geese are common year-long residents. The camas pocket gopher, largest gopher in the Pacific Northwest, and the California ground squirrel, a recent invader, are common valley inhabitants. Band-tailed pigeon, once common to the valley and adjacent forested foothills, are now limited in their distribution and abundance. Lakes, reservoirs and streams support populations of rainbow trout and introduced crappie and largemouth bass. Anadromous fish runs of chinook and silver (Coho) salmon represent diminished runs and significantly reduced distribution. Shad and smelt are unique species that also occur in major river systems, but numbers are greatly reduced. More than 7,000 species of arthropods, a variety of amphibians and reptiles, and slugs occur.

Climate. Precipitation ranges from 25 to 60 in (630 to 1,620 mm), occurring mostly as rain during October through June. Mean annual temperature is 47 to 57 °F (9 to 13 °C). The growing season lasts 140 to 240 days.

Surface Water Characteristics. There are large riverine systems with merging streams. The Puget Trough portion is joined by estuaries and ocean sound. Wetlands are abundant. Both natural and man-made lakes are scattered throughout the Section.

Disturbance Regimes. Fires were commonly set by Native Americans and trappers, hunters, and settlers. Floods from intense winter storms occurred at frequent intervals prior to construction of dams.

Land Use. The Willamette Valley is a dominantly intensive agricultural area. More than 100 kinds of crops are grown—from grass seed and row crops to berries and nuts. Grazing by sheep and cattle is common. Private forestry and intensive industrial forestry occur on the footslopes of the valley perimeter. The Puget Trough is managed largely for intensive industrial and private forestry. Grazing in pasture, and crop land is dispersed throughout and is in small parcels. Several large metropolitan areas and industrial complexes occur. Small rural communities also occur throughout the Section.

Cultural Ecology. The earliest human occupation of the Willamette Valley and Puget Trough Section dates to about 9,000 years ago. Early peoples depended heavily on the hunting of deer and elk, and led a highly mobile existence. By 6,000 years ago, a more diverse economic strategy had emerged. In the south, this included an emphasis on the collection and processing of camas, acorns, and hazelnuts, in addition to hunting. In the north, there was a greater dependence on riverine salmon fishing and the gathering of intertidal shellfish. By 4,000 years ago an increase in sedentism was linked to greater reliance on stored food resources, and resulted in the establishment of villages on high river terraces, valley margins, and the shorelines of Puget Sound. Prairies in the Willamette Valley and around Puget Sound were fire-maintained to enhance productivity of various plant resources. As complex geomorphic changes in the Puget Sound basin affected the distribution of food resources, subsistence activities shifted to take advantage of more microenvironments. In the Willamette Valley, the localized abundance of a wide variety of food resources on the valley floor meant the opposite. greater sedentism and smaller home ranges. As the adaptive characteristics of classic northwest coast culture developed about 2,000 years ago on Puget Sound, social and religious systems involving the ownership of salmon and other resources arose, persisting into the historic period. British and American settlement began following the establishment of fur trade posts in the 1820's and 1830's. Open prairies were appropriated for agricultural use. Extensive clearing and the cultivation of non-native crops was central to the economy of 19th century communities. In the Puget Sound area, intensive timber harvest had a dramatic effect on ecological structure and hydrology. The historic development of towns and cities, river diking and damming, harbor construction, and roads and railroads all caused significant local changes to the environment.

Compiled by Pacific Northwest Region.

Province M242–Cascade Mixed Forest - Coniferous Forest - Alpine Meadow

Three Sections have been delineated in this Province: M242A–Oregon and Washington Coast Ranges; M242B–Western Cascades; and M242C–Eastern Cascades. These Sections are located in Washington and Oregon. The area of these Sections is about 53,400 mi² (138,300 km²).

Section M242A–Oregon and Washington Coast Ranges

Geomorphology. These primarily highly dissected low mountains were shaped by debris slide and avalanche erosion processes on slopes of 40 to 120 percent. Incised valleys are distributed throughout the Section. The Olympic Mountains in the north are an anomalously high range, with very deeply incised, fault-controlled drainages which experienced episodes of glaciation. Coastal lowlands formed from active mountain erosion have slopes less than 30 percent and are formed into marine and riverine terraces. Dunes and bogs occur along the coast, with numerous headlands formed of more resistant rock. Elevation range from sea level to 1,800 ft (545 m) is dominant. Most mountain tops are below 4,000 ft (1,212 m). Olympic Mountains peaks extend to 8,000 ft (2,424 m). Local relief is 200 to 800 ft (60 to 242 m).

Lithology and Stratigraphy. Generally Eocene, Miocene, and late Oligocene marine sandstones, siltstones, and shales are interspersed with marine basalts. Northern portions are covered with till, outwash, and lacustrine sediments. Types range from metamorphosed Eocene and Oligocene sandstones to greenishists and graywackes from the Olympic Mountains. Coastal lowlands are formed of river-borne detritus from the low mountains and rest on complex deltaic sediments. Headlands formed from mostly basalt, but occasionally from conglomerates and sandstones.

Soil Taxa. On the low mountains that dominate this section, typical soils are moderately deep or deeper, and have dark, humus-rich topsoil and low base saturation. The upper horizons of these soils have low bulk density, and amorphous material is dominant in the clay-size fraction. Soil moisture regime is udic and soil temperature regime is mesic or frigid (Alic Hapludands and Andic Haplumbrepts). In the rain shadow east of the Olympic Mountains, the soil moisture regime is xeric (Dystric Xerochrepts and Typic Xerumbrepts). Soils on the high mountains are similar but colder, having a cryic soil temperature regime (Typic Haplocryands and Andic Cryochrepts). Some have a cemented layer that impedes water and roots (Typic and Alic Duricryands). Soils that are continuously moist, a perudic moisture regime (Alic Fulvicryands), occur in the high Olympic Mountains. In the coastal lowlands and hills, seasonal soil temperatures are moderated by fog and sea breezes, resulting in



Highly productive, Douglas-fir forests on dissected mountains which range from moderately stable to unstable; soil types include udic to mesic Andisols and Inceptisols of the Oregon Coast Range.

isomesic and isofrigid temperature regimes. Soils formed in sandy aeolian deposits have accumulations of iron, aluminum, and humus in subsoil horizons, and some have organic matter-rich surface horizons (Entic and Humic Haplorthods, and Andic Haplumbrepts). Poorly drained soils with an accumulation of organic matter near the surface occur on low marine terraces (Histic Haplaquepts, Typic Humaquepts, and Fluventic Humitropepts). On low hills in the fog belt are soils with humus-rich topsoil, low bulk density, and amorphous material in the clay-size fraction (Andic and Typic Humitropepts, and Alic Fulvudands).

Potential Natural Vegetation. Küchler vegetation types are spruce-cedar-hemlock forests in the coastal fog belt and lower mountain slopes. The dominant type, on upper slopes, is cedar-hemlock-Douglas-fir forests. The Olympic Mountains include an area of alpine meadows and barrens and western spruce-fir forests on cryic soils. More recent vegetation classification is more specific. Lower mountain slopes are dominated by Western Hemlock series. Coastal fog belt areas are dominated by Sitka Spruce and Western Hemlock series. Western Red Cedar series is abundant in the drainages and lower elevations where soil moisture is abundant. Pacific Silver Fir series is dominant on the cryic soils. Shore Pine series occurs on dunes.

Fauna. The Roosevelt elk and blacktail deer, large herbivores, were not common in coastal Douglas-fir forests prior to settlement and forest harvest. Both species are now common and widespread. Black bear, a common species, represents the large predator and coyotes represent the opportunistic small predator. Cougar and bobcat are now common predators, but, like the elk and deer, were not common prior to forest harvest. Spotted owl and murrelet were common species associated with late seral coastal forest plant associations. Both species are Federally listed due to limited opportunity to find habitat within late seral stage forest types. Nutria and opossum, non-native species, are commonly associated with rivers, lakes, and estuaries. Townsends mole is a widespread and abundant inhabitant of lowland flood plains and meadows. The saltwater-freshwater interface zone supports a variety of shore birds, waterfowl, mollusks, and anadromous fishes. The silver spot butterfly, a Federally listed species, is found only in this area and is very limited in distribution. Mountain beaver occurs only in this area as a unique species. Large mammals, including the whale, sea lion, and seal, are common components of adjoining marine waters. Other important inhabitants are more than 7,000 species of arthropods, a variety of amphibians and reptiles, and slugs.

Climate. Precipitation averages 60 to 240 in (1,520 to 6,100 mm) as rain during November to April. Summers

are relatively dry. The rain shadow of the Olympic Mountains is about 30 in (760 mm). Average annual temperature is 32 to 53 °F (0 to 12 °C). The growing season lasts 30 to 250 days, but in most areas is more than 140 days.

Surface Water Characteristics. The streams and rivers are a high density of deeply incised, steep gradient, dendritic drainages. Many larger rivers become low-gradient systems prior to entering the tidal influence zone. Relatively small (less than 10 acres) freshwater lakes are disbursed throughout the Section. The Coastal terraces and dune areas are occupied by some lakes that are several hundred acres. Numerous bays and estuaries occur along the coast at the mouth of larger rivers.

Disturbance Regimes. Winter storms of 25 to 100 year magnitude produce windthrow and landslides. Stand replacement fires occurred at irregular intervals of 90 to 250 years. They may have been more frequent on upper slopes and ridges and near the coast.

Land Use. Dominant land use is intensive forestry. Sport fishing and hunting are common. Gathering of special forest products, such as mushrooms, ferns, shrubs, lichens, and mosses, is increasing. Coastal areas are dominated by small communities and tourism.



Western hemlock and Douglas-fir forests on moderate to highly dissected slopes on udic and mesic Andisols and Inceptisols of the Washington Coast Range.

Cultural Ecology. The rugged Pacific coastline and Coast Range environments of Oregon and Washington have undergone many changes as a result of human settlement and use. The earliest campsites of Native American peoples were apparently covered by rising sea levels as the last Ice Age ended some 12,000 years ago. By 8,000 years ago, archaeological sites discovered near the coastline show that these early peoples hunted terrestrial mammals, gathered roots and berries, and exploited the anadromous fish runs. Technological innovations and population growth increasingly drew American Indians to the ocean headlands, bays, and estuaries as rich and reliable sources of food and favorable places for fishing stations and semi-permanent village sites. By 5,000 years ago, these popular fishing stations and villages created extensive midden deposits along the Pacific coastline and altered local topographic settings and vegetation; today many coastal communities are located atop ancient shell middens and villages. The Euro-American settlement of the Oregon Coast Range from the mid-1800's to late 1800's caused numerous, accidentally set fires that cumulatively burned millions of acres of Coast Range forest. Coast Range homesteaders also cleared the forest and introduced new plant and tree species, thus creating environmental "patches" or niches that are important today for big game forage, wildlife diversity, and recreation. Beginning in the 1940's, industrial logging, road construction, valley

bottom farming, commercial fishing, and recreational developments along the Pacific coastline and in the Coast Range have all left significant imprints on the natural environment of this region.

Compiled by Pacific Northwest Region.

Section M242B—Western Cascades

Geomorphology. This is an uplifted sequence of extrusive volcanics and volcanoclastic rocks, interspersed with intrusives, that have been dissected by large order riverine systems. Two predominant landforms of the western slope are ancient slide complexes with deep weathering zones on relatively gentle terrain, and a steeply dissected debris slide terrain associated with thin soils and resistant rock units. Alpine glaciation has left till and outwash deposits at the higher elevations. The high Cascades to the east of the Section are active volcanoes with evidence of recent, and in some cases, remnant glaciation. The northern part of the Section contains more metasediments than the southerly portion and abounds with classical U-shaped valleys and cirques. Elevation ranges from near sea level at the Columbia River to greater than 14,000 feet (4,516 m) in the peaks of the Cascade Mountains. Most of the Section is between 2,000 and 7,000 feet (645 and 2,258 m). Local relief is more than 1,000 feet (322 m) in most of the Section.



Western hemlock and Pacific silver fir forests on moderately stable, glaciated slopes and frigid, cryic, and udic soils of the Western Cascades. A wet meadow is in the foreground.



Mount Hood, one of many active volcanic peaks typical of the High Cascades part of the Western Cascades Section. Pacific silver fir forest on cryic and udic Spodosols.

Lithology and Stratigraphy. Types include mostly a mixture of Miocene-Pliocene extrusive rocks, dacite to basalt, with intrusive granites, and diorites interspersed. These are sandwiched in with numerous pyroclastic deposits of tuffs and breccias. In a number of locations, hydrothermal alteration has played a significant role in secondary mineralization of breccias. The high Cascades are 85 percent basalt, with dacites secondary. Active mountain building has taken place from early Pliocene to the present. In the northern third of the Section, above the Olympic-Wallowa lineament, gneisses, schists, metasediments, and metavolcanics and lacustrine deposits occur.

Soil taxa. Soils on the west slope of this Section have organic matter-rich topsoil with low base saturation. Included soils have low bulk density and contain amorphous material (Typic and Alic Hapludands, and Andic Haplumbrepts); contain volcanic ash (Typic and Humic Udivitrands); or have iron, aluminum, and humus accumulation in subsoils (Typic Haploorthods). These soils have a udic moisture regime, and most have a frigid soil temperature regime. At lower elevations, warmer soils

with a mesic temperature regime have organic matter-rich topsoil with low base saturation (Typic Haplumbrepts), and soils in well-weathered parent material have clay-enriched subsoils (Typic Haplohumults). In the High Cascades and North Cascades are cold, stony soils with a cryic temperature regime. Included are soils with generally greater amounts of organic matter, but otherwise very similar to frigid soils on the West Slope (Andic and Typic Humicryods, Typic and Vitric Haplocryands, Typic Fulvicryands, and Andic Cryumbrepts).

Potential Natural Vegetation. According to Kuchler, the dominant vegetation is silver fir-Douglas-fir forest. The next most abundant is fir-hemlock forest. At the highest elevations, there are dispersed areas of alpine meadow and barrens. In the northernmost portion, there is western spruce-fir forest. Western Hemlock series dominates the frigid and udic regimes. Western red cedar is common in drainages. Cryic regimes are dominated by Pacific Silver Fir, Mountain Hemlock and Subalpine Fir series. Parkland of forbs, grasses, shrubs, lichens, mosses, and krummholz are interspersed at the high elevations above timberline.

Fauna. Large herbivores and carnivores include Roosevelt elk, blacktailed deer, and black bear. Mountain goats inhabit high elevations in the central and northern part of the Section. Smaller members are beaver, otter, raccoon, fisher, marten, skunk, coyote, cougar, squirrel, rabbit, and numerous rodents. A variety of birds such as blue and ruffed grouse, band-tailed pigeon, mountain quail, owls, hawks, and songbirds are common. The pileated woodpecker and other cavity nesters are common. The wetlands are home to many waterfowl, including Canada geese, ducks, herons, and various song birds. The bald and golden eagle and the peregrin falcon are somewhat rare; osprey are common along riparian areas. Anadromous fish such as coho, chinook, chum, and pink salmon and steelhead and sea-run cutthroat trout inhabit the streams and rivers. Rainbow and bull trout are in warm water lakes and streams. Shad and smelt are unique species that occur in some major river systems, but numbers are diminished. Other important inhabitants are more than 7,000 species of arthropods, a variety of amphibians and reptiles, and slugs.

Climate. Precipitation ranges from 50 to 150 in (1,300 to 3,600 mm), mostly as rain and snow during October to June. Summers are relatively dry. Average annual air temperature is 30 to 52 °F (-1 to 11 °C). The growing season ranges from less than 30 days to 240 days.

Surface Water Characteristics. Stream densities commonly are one and one-half to two miles of perennial streams per square mile. Intermittent streams are equally common. Many major rivers occur from the northern end to the southern range of the Section. Water quality is exceptionally high. Many of the stream systems from glacial areas are naturally milky and turbid during the spring snowmelt. Numerous natural lakes resulting from glacial processes and ancient landslides occur throughout

the Cascades. Man-made reservoirs are common at the lower elevations. Localized wetlands are scattered throughout the Section.

Disturbance Regimes. Fire periodicity is extremely variable from decades to centuries for major stand replacement occurrences. Snowpacks of tens of feet may be accompanied by rain-on-snow events at the low to mid elevations and may result in frequent floods and erosional processes. Insects and diseases, especially root rots, are common. Windthrow is common in localized areas.

Periodic volcanic eruptions alter the physical terrain, biota, and aquatic features.

Land Use. Most of the Section is in national forest and other Federal and State public land. It is managed under principles of ecosystem management for uses ranging from intensive forestry to wilderness. Much of the area is in municipal supply watersheds. There are two national parks and several designated scenic and recreation areas, and a national volcanic monument. Lowest elevations frequently are in industrial forest management and small areas of nonindustrial private forestry. The river valleys usually have small, rural communities and dispersed settlements. They also are grazed by livestock, produce hay and other crops, and are major travel corridors for tourists and commerce.

Cultural Ecology. Human occupation of the Cascade Mixed Forest Province began at least 8,000 years ago, possibly as a response to drier conditions and expanding game populations. Prior to about 5,000 years ago, small, highly mobile hunting and gathering groups used the area, moving their camps to obtain seasonally available montane resources. With the subsequent development of more permanent settlements and increasing human populations, the focus of upland use was to acquire and process specific berries, roots, and game animals as supplements to lowland staples. Settlements consisted of small plankhouse or pithouse clusters along the upper reaches of major rivers draining the Cascades, with each cluster being populated by two or three family groups. East-west interactions between groups on both sides of the Cascades was facilitated by travel routes along ridges and through mountain passes. Deer were a principal economic resource, and productive habitat was maintained through intentional burning, a practice which also improved the productivity of huckleberries and certain root crops. Fishing for salmon was also important, and was generally conducted using traps and weirs or netting at falls and rapids. Euro-American settlement began in the mid-1800's, increasing substantially about 1880. Historic settlements initially involved farming or ranching in the valley bottoms, with the economic focus eventually shifting to timber resources. Mining activity, though localized in mineralized areas, commenced in the early 1860's with discovery of gold in the Swauk and Liberty districts. Placer operations resulted in substantial soil and vegetation disturbance, as well as significant water source diversions. From the 1880's through the 1930's, industrialized mining occurred: gold in the Monte Cristo

vicinity; coal from present day Black Diamond through the Cascades to Roslyn; copper from Holden Mine in the Railroad Creek drainage tributary to Lake Chelan; and tungsten on the east flank of the North Cascades. These operations involved removal of vegetative cover for mine timbers, extensive land modification, and deposit of overburden, spoils, and tailings, including toxic materials used in processing. Timber harvest, grazing, mineral extraction, and the construction of dams resulted in ecological effects far greater than those produced by the prehistoric cultures of the region.

Compiled by Pacific Northwest Region.

Section M242C—Eastern Cascades

Geomorphology. Glaciation of high volcanic peaks has resulted in a relatively steep eastern slope for the Section. High energy streams and flows of debris and mud are common. Glacial forms have not stabilized. Classical U-shaped valleys and cirques abound in the northern part of the Section. To the south, glaciation was less severe and gradually diminishes towards the southern limit of the Section. Individual volcanic peaks rise above the surrounding incised topography. Many are still active, primarily south of the Olympic-Wallowa lineament. Statistically, an eruption occurs about every 25 years. Small recent volcanic vents are common on the flanks of larger volcanoes. Large areas of fresh lava flows abound in the east of this Section. Volcanic ash from earlier eruptions originally blanketed the east slope. This ash has been concentrated in a southern pumice plateau, blanketing all but the higher hills and ridges. Elevation ranges from near sea level at the Columbia River to more than 10,000 ft (3,300 m) in the high mountain peaks.



Old-growth ponderosa pine and bitterbrush forest, with recent prescribed underburn on cryic and xeric pumiceous soils of the southern part of the Eastern Cascades Section, Oregon.



Mixed conifer forest on cryic to frigid, udic to xeric soils in an east-sloping glacial valley typical of the northern part of the Eastern Cascades Section, Washington. Note the characteristic riparian area on valley floor in foreground.

Most of the Section is between 3,000 and 7,000 ft (968 and 2,258 m). Local relief varies from about 200 ft in the plateau regions to more than 2,000 ft in the deeply dissected mountains.

Lithology and Stratigraphy. The Section is composed of pre-Pliocene to recent andesite and basalt flows, forming composite cones and intracanyon flows. These rest on extensive deposits of Pliocene to lower Pliocene basalt and andesitic varicolored tuff, tuff breccia, and agglomerate. Deposits of volcanic ash, pumice, and cinders are common and may be hundreds of m thick. Locally, there are intrusive granitics, gneisses, schists, metavolcanics, and metasediments. The stratigraphy is variable even in the local sense.

Soil Taxa. This Section includes a narrow area of the High Cascades described in the Western Cascades Section (M242B). Soils in the High Cascades of this Section are the same as those in the High Cascades of the Western Cascades Section, except in southern Washington. That area includes soils with a thick volcanic ash mantle (Typic Vitricryands) and soils with thick, dark, base-rich topsoil (Pachic Cryoborolls). Due to the rain shadow, soils on the east slope are usually dry for a significant time during the summer. These soils have a xeric moisture regime. Many

of these soils are influenced by volcanic ash, some have low bulk density, some have organic matter-rich topsoil, and some have subsoils with accumulated clay (Typic and Humic Vitrixerands; Dystric, Typic and Vitrandic Xerochrepts; Typic and Vitrandic Xerumbrepts; Ultic and Vitrandic Haploxeralfs and Palexeralfs; and Ultic Haploxerolls). In the southern part of this Section, soils have formed in volcanic ash and pumice from Mount Mazama on a plateau with relatively low relief, compared to the rest of this Section. Due to thermal properties of the tephra and dry climate, cold soils with a cryic temperature regime are common. The cold, cryic soils (Xeric Vitricryands) occur in depressions; the cool, frigid soils (Humic and Lithic Vitrixerands) occur on upland positions in the landscape.

Potential Natural Vegetation. According to Küchler, the dominant vegetation is silver fir–Douglas-fir forest. The next most abundant is fir-hemlock forest. At the highest elevations, there are dispersed areas of alpine meadow and barrens. In the northernmost portion, there is western spruce-fir forest. Vegetation series is highly variable and diverse in the Eastern Cascades Section. Ponderosa Pine and Lodgepole Pine series dominate the lower elevations. In the pumice plateau of Oregon they are largely on cryic and xeric soils. Ponderosa

Pine series also is in the mesic and frigid and xeric regimes. In the northern part of the Section, Lodgepole Pine series is mostly in cryic regimes. Douglas-fir series occupies frigid and xeric regimes. The higher elevations are dominated by White Fir, Grand Fir, Pacific Silver Fir, and Subalpine Fir series. Local areas of White Bark Pine, and Engelmann Spruce series occur. Quaking aspen occurs adjacent to and in some wet areas. Grass and sedge meadows (dry to wet) are scattered.

Fauna. Large herbivores and carnivores include elk, blacktailed and mule deer, and black bear. Mountain goats inhabit high elevations in the central and northern part of the Section, but are absent from the southern portion of their range. Small mammals are beaver, otter, raccoon, marten, skunk, coyote, cougar, squirrel, rabbit, and numerous rodents. Fisher, once common in this Section, are now rare or extirpated from much of their former ranges. A variety of birds such as blue and ruffed grouse, band-tailed pigeons, mountain quail, owls, hawks, and songbirds are common. Pileated woodpeckers and other cavity nesters are common. The wetlands are home to many waterfowl such as Canada geese, ducks, herons, and various song birds. The bald and golden eagle inhabit a small portion of their historic ranges and are very limited in distribution. The peregrine falcon, once common, is now represented by a few pairs introduced by "hacking" potential sites. Anadromous fish such as coho, chinook, chum, and pink salmon and steelhead and sea-run cutthroat trout inhabit the streams and rivers, their distribution and numbers are significantly reduced. Rainbow trout are the common cold water inhabitant. Bull trout are found, but their occurrence is significantly restricted from historic ranges. Kokanee, an introduced species, is found in some lakes and streams, primarily in the north portion of this Section. Other important inhabitants are more than 7,000 species of arthropods, and a variety of amphibians and reptiles.

Climate. Precipitation ranges from 20 to 120 in (500 to 3,040 mm), occurring mostly as rain and snow in fall, winter, and spring. Temperature ranges from 30 to 52 °F (-1 to 11 °C). The growing season lasts 30 to 220 days.

Surface Water Characteristics. Stream densities are variable. In the pumice region of Oregon, streams are few. In the northern part of the Section, densities may be as high as one and one-half to two miles of perennial streams per square mile. Water quality is exceptionally high. Numerous man-made reservoirs occur at the lower elevations. Many streams are flashy, and differences between peak and low flows are large. Localized wetlands are scattered.

Disturbance Regimes. Fire periodicity is extremely variable. In the ponderosa pine-lodgepole pine mix at the lower elevations, fires commonly occurred in 10 to 15 year intervals prior to fire suppression in the last several decades. Fire also is common at the higher elevations. Insect epidemics are common in dense, overstocked stands. Root rots are common.

Land Use. Most of the Section is in national forest and other Federal and State public land. It is managed under principles of ecosystem management for uses ranging from intensive forestry to wilderness. Much of the area is in municipal supply watersheds. There are portions of two national parks and several designated scenic and recreation areas. Lowest elevations frequently are in industrial forest management. Two large Native American reservations are partly in and adjacent to this Section. The river valleys usually have small, rural communities and dispersed settlements. They also are grazed by livestock, produce hay and other crops, and are major travel corridors for tourists and commerce.

Cultural Ecology. Human occupation of the Cascade Mixed Forest Province began at least 8,000 years ago, possibly as a response to drier conditions and expanding game populations. Prior to about 5,000 years ago, small, highly mobile hunting and gathering groups used the area, moving their camps to obtain seasonally available montane resources. With the subsequent development of more permanent settlements and increasing human populations, the focus of upland use was to acquire and process specific berries, roots, and game animals as supplements to lowland staples. Settlements consisted of small plankhouse or pithouse clusters along the upper reaches of major rivers draining the Cascades, with each cluster being populated by two or three family groups. East-west interactions between groups on both sides of the Cascades was facilitated by travel routes along ridges and through mountain passes. Deer were a principal economic resource, and productive habitat was maintained through intentional burning, a practice which also improved the productivity of huckleberries and certain root crops. Fishing for salmon was also important, and was generally conducted using traps and weirs or netting at falls and rapids. Euro-American settlement began in the mid-1800's, increasing substantially about 1880. Historic settlements initially involved farming or ranching in the valley bottoms, with the economic focus eventually shifting to timber resources. Mining activity, though localized in mineralized areas, commenced in the early 1860's with discovery of gold in the Swauk and Liberty districts. Placer operations resulted in substantial soil and vegetation disturbance, as well as significant water source diversions. From the 1880's through the 1930's, industrialized mining occurred: gold in the Monte Cristo vicinity; coal from present day Black Diamond through the Cascades to Roslyn; copper from Holden Mine in the Railroad Creek drainage tributary to Lake Chelan; and tungsten on the east flank of the North Cascades. These operations involved removal of vegetative cover for mine timbers, extensive land modification, and deposit of overburden, spoils, and tailings, including toxic materials used in processing. Timber harvest, grazing, mineral extraction, and the construction of dams resulted in ecological effects far greater than those produced by the prehistoric cultures of the region.

Compiled by Pacific Northwest Region.

Province M244-Pacific Coastal Mountains Forest - Meadow

Three Sections have been delineated in this Province: M244A-Chugach-St. Elias Mountains; and M244B-Lynn Canal; M244C-Boundary Range. These Sections are located in southern and southeastern Alaska and partly border the Gulf of Alaska. The area of these Sections is about 40,000 mi² (103,600 km²).

Section M244A-Chugach-St. Elias Mountains

Geomorphology. The Kenai, Chugach, and St. Elias Mountains form a rugged, crescent-shaped barrier along the coast of the Gulf of Alaska. High segments of the mountains are dominated by extremely rugged east-trending ridges. The entire range is heavily glaciated, and the topography is characterized by horns, aretes, cirques, and U-shaped valleys. The south coast is deeply indented by fjords and sounds, and the ridges extend southward as chains of islands. Elevation ranges from 330 to greater than 14,750 ft (100 to more than 4,500 m).

Lithology and Stratigraphy. This Section consists of Chugach terrane composed of near-shore oceanic rock of late Mesozoic age. The mountains are composed of chiefly metamorphosed slate and graywacke that have pronounced vertical cleavage that strikes parallel to the trend of the ridges. A belt of Paleozoic and Mesozoic schist, greenstone, chert, and limestone lies along the north edge of the mountains. All these rocks are cut by granitic intrusions.

Soil Taxa. Where not covered by glaciers, ice fields, and rock outcrops, soils have developed from glacial till and colluvium. Dominant soils are Lithic Cryorthents, Andic Cryumbrepts, Pergelic Cryumbrepts, Typic Cryumbrepts, Typic Haplocryods, Andic Humicryods, Humic Cryorthods, and Humic Lithic Cryorthods.

Potential Natural Vegetation. Most of the Section is either barren, ice-covered, or mantled with alpine tundra heath meadows. Some spruce-hardwood forests occur along the largest rivers.



Active glaciers on the landscape of the Chugach Range.

Fauna. The alpine tundra vegetation in this Section provides habitat for a limited number of species. Surfbirds and rosy finches are uncommon breeders in this Section. Mountain goats utilize these high elevation habitats during the summer.

Climate. Average annual precipitation ranges from 12 to 160 in (300 to 4,060 mm). Average annual temperature ranges from 24 to 40 °F (-4 to 4 °C), depending on elevation and aspect. Killing frosts can occur any month of the year.

Surface Water Characteristics. Streams are short and swift, and headwater in glaciers. Lakes lie in ice-carved basins. Wetlands occupy less than 3 percent of the area.

Disturbance Regimes. Wildfire occurrence is low, whereas snow and rock avalanches are common.

Land Use. Permanent settlements are rare. Past mining perturbations are still detectable.

Cultural Ecology. Historic residents include Tanaina and Ahtna Athabaskans; Alutiiq Eskimos; Eyaks; and Tlingits.

Compiled by Alaska Region.

Section M244B—Lynn Canal

Geomorphology. The area is dominated by rugged glaciated mountains with deep V-shaped and U-shaped valleys. Many of the bays have narrow borders of hilly moraines, with short flat-bottomed valleys at the head. Most slopes throughout the Section are steep. Elevation ranges from sea level to over 14,750 ft (4,500 m).

Lithology and Stratigraphy. The area consists of continental fragments of the Craig subterrane, composed of northwest-trending belts of Triassic to Mesozoic sedimentary, volcanic, and crystalline schist, gneiss, and granitic rocks.

Soil Taxa. Where not covered by glaciers, ice fields, and rock outcrops, soils have developed from glacial till and colluvium. Dominant soils are Lithic Cryorthents, Typic Cryumbrepts, Typic Haplocryods, Humic Cryorthods, and Humic Lithic Cryorthods.

Potential Natural Vegetation. Since the Section is partially modified by polar air masses, the prevailing vegetation is quite diverse. Forest vegetation dominated by western hemlock and Sitka spruce predominate in the low-lying areas up to 300 m in elevation. Mixed conifer, black cottonwood, and lodgepole pine forest types occur on drier inland sites. Low-growing alpine tundra vegetation of sedges and mosses prevails on sites above tree line.

Fauna. Bald eagles and marbled murrelets nest in forested areas. Red-breasted sapsuckers, Pacific-slope

flycatchers, golden-crowned kinglets, and red and white-winged crossbills are common breeders. Blue grouse are found throughout the area. Northern water shrews are commonly present. Porcupines, river otters, and mink are found throughout the Section. Mountain goats occupy habitats from alpine to forested slopes. Sitka black-tailed deer occur throughout the Section. Moose live in habitats associated with the major river systems. Brown bears, black bears, and gray wolves occur in low numbers. Boreal toads occur in this Section. King salmon are associated with the major, mainland rivers. Pink salmon are the most numerous of the salmon species. Dolly varden are the most widely distributed resident fish.

Climate. Average annual precipitation ranges from 30 to 120 in (760 to 3,050 mm). Average annual temperature ranges from 33 to 41 °F (1 to 5 °C). The growing season is from May 15 to September 30. At higher elevations, killing frost can occur at any time of the year.

Surface Water Characteristics. Streams are short and swift and headwater in glaciers. Lakes lie in ice-carved basins. Wetlands occupy less than 3 percent of the area.

Disturbance Regimes. Due to the general steepness of the terrain, landslides and avalanches are common.

Land Use. Several small communities occur in this Section. Subsistence and recreational activities are the major land uses.

Cultural Ecology. This Section historically has been occupied by Tlingit Indians.

Compiled by Alaska Region.

Section M244C—Boundary Range

Geomorphology. The area is dominated by rugged glacier-covered mountains or glaciated mountains with deep V-shaped and U-shaped valleys that straddle the international boundary with Canada. Most slopes throughout the Section are steep. Elevation ranges from sea level to over 9,840 ft (3,000 m).

Lithology and Stratigraphy. The Boundary Ranges are underlain mostly by massive granitic and gneissic rocks of the Coast Range batholith; a belt of schist and phyllite along its western margin and magmatized roof pendants within the batholith give a strong westwardly grain to the topography. Small fragments of the Taku terrane occur at the extreme western portions.

Soil Taxa. Where not covered by glaciers, ice fields, and rock outcrops, the soils have developed from glacial till and colluvium. Dominant soils are Lithic Cryorthents and Humic Lithic Cryorthods.

Potential Natural Vegetation. Most of the area is either barren, ice-covered, or covered by alpine heath

meadows. Forest vegetation of hemlock and spruce occurs along river corridors within mountain passes.

Fauna. The alpine tundra vegetation in this Section provides habitat for a limited number of species. Mountain goats utilize these high elevation habitats during the summer.

Climate. Average annual precipitation ranges from 40 to 100 in (1,020 to 2,540 mm). Average annual temperature ranges from 39 to 43 °F (4 to 6 °C). Killing frost can occur at any time of the year.

Surface Water Characteristics. Streams are steep and fast flowing. A few small lakes lie in rock basins on valley

floors and in mountainside hollows in the ice-free portions. Wetlands occupy less than 3 percent of the area.

Disturbance Regimes. Snow avalanches create large-scale vegetation disturbances. Wildfire is of little consequence.

Land Use. Human settlements and uses of the area are few.

Cultural Ecology. Historically this Section has been occupied by Tlingit Indians.

Compiled by Alaska Region.

Province M245–Pacific Gulf Coastal Forest - Meadow

Three Sections have been delineated in this Province: M245A–Northern Gulf; M245B–Northern Alexander Archipelago; and M245C–Southern Alexander Archipelago. These Sections are located in southern Alaska, bordering the Gulf of Alaska, and include part of Kodiak Island. The area of these Section is about 35,000 mi² (68,000 km²).

Section M245A–Northern Gulf

Geomorphology. This area includes Afognak Island, Prince William Sound, coastal lowlands of Copper River Delta, and Yakutat Forelands. The foreland areas consist of alluvial fans, uplifted estuaries, morainal deposits, dunes, river deltas, and terraces. Crustal uplifting has created terraces or dunes that run parallel to the coastline. Erosion by glacial outburst floods dissect the forelands and dominate landscape patterns. The headlands within Prince William Sound and Afognak Island are erosional bedrock features that end as sea cliffs at the water's edge where little to no deposition occurs except in bays and shallow estuaries. Elevation ranges from sea level to 500 ft (150 m).

Lithology and Stratigraphy. The area consists of Quaternary to recent sediments in the foreland and delta areas. Uplands consist of near-shore oceanic rocks of the Prince William, Chugach, and Yakutat terranes of interbedded sedimentary, volcanic rock types with ages from Paleozoic to upper Mesozoic. Slate and graywacke are prevalent rocks.

Soil Taxa. Soils near the mountains formed in gravelly and stony morainal deposits. Soils of river deltas, terraces, alluvial fans, and flood plains form in water-laden sands and silts. Poorly drained depressions are filled with peat. Typical soils are Terric Cryohemists, Humic Cryorthods, Humic Lithic Cryorthods, and Andic Humicryods.

Potential Natural Vegetation. Coastal subpolar rainforests of western hemlock and Sitka spruce are characteristic in areas with better soil drainage. Along the coastline, areas with high water tables support sphagnum mosses, sedges, and willows, which foster peatland development. Alder, cottonwood, and birch dominate the low-lying areas and along major river channels.

Fauna. The entire population of dusky Canada geese nests within this Section. Trumpeter swans are considered a common breeder, especially on the Copper River Delta. Bald eagles, marbled murrelets, and Kittlitz's murrelets utilize forested habitats adjacent to the waters of Prince William Sound. Bonaparte's gulls are commonly observed. Sea otters and Steller's sea lions are common throughout

Prince William Sound. Mountain goats occupy habitats from alpine areas into the forested slopes. Sitka black-tailed deer were introduced from 1916 through 1923 and now occupy most of the islands and the adjacent mainland of Prince William Sound. Roosevelt elk were introduced to Afognak Island in 1929. From 1949 through 1957 moose were introduced to the Copper River Delta. Rough-skinned newts and boreal toads have been reported from this Section. Pink and chum salmon are the major salmon species present. The Copper River supports a significant population of sockeye salmon. Both anadromous and nonanadromous populations of dolly varden are present in this Section.

Climate. Average annual precipitation ranges from 30 to 160 in (760 to 4,060 mm). Average annual temperature ranges from 30 to 42 °F (-1 to 6 °C). The growing season lasts approximately from May 10 to September 30.

Surface Water Characteristics. Most streams head in glaciers from mountains of adjoining areas and are low-gradient braided systems with overbank flooding and glacial outburst floods common in some watersheds. Wetlands occupy approximately 30 percent of the area, with the majority in Copper River Delta, Yakutat, and other lowland areas.

Disturbance Regimes. Wildfire occurrence is rare. Glacial outburst floods and tectonic events have changed the character of many of the areas. Land subsidence or uplifting abruptly changes successional pathways and accelerated erosion or deposition.

Land Use. Human use is common, with commercial timber harvesting, fishing, mining, and recreational activities occurring year around. Roads, airstrips, and abandoned rail lines attest to the significant human presence, all of which affect local ecosystems to varying degrees.

Cultural Ecology. Alutiiq Eskimos (west), Eyaks (central), and Tlingits (east) were original inhabitants.

Compiled by Alaska Region.

Section M245B–Northern Alexander Archipelago

Geomorphology. This Section includes Baranof, Chichagof, and Admiralty Islands, and the portion of the mainland below the permanent snowfields in southeast Alaska. These areas have rugged topography with many long and broad U-shaped glaciated valleys, many of which terminate at tidewater. Side slopes are very steep and exposed bedrock is common along the glacially scoured valley walls. The rolling moraine landforms dominate the

low hills and valley bottoms. Elevation ranges from sea level to over 3,280 ft (1,000 m).

Lithology and Stratigraphy. The geology is very complex, consisting of the Craig and Admiralty subterranean, and the Wrangellia, Chugach, and Taku terranes, all of which are volcanic islands-arcs and continental fragments. Most rock types are Jurassic to Mesozoic deposits of sedimentary and volcanic rock types. Many of the assemblages have been metamorphosed, faulted, or folded, and the trending of most faults is northwesterly.

Soil Taxa. Predominant soils are Terric Cryohemists, Humic Cryorthods, Humic Lithic Cryorthods, and Andic Humicryods. Most of the soils on the steep slopes are formed in colluvial or landslide materials. Poorly drained depressions or low-lying areas are peatlands.

Potential Natural Vegetation. Perhumid rainforests of Sitka spruce and western hemlock predominate. Water-tolerant plants, such as sphagnum moss, sedges, bog kalmia, and shore pine, occur in peatlands. Alpine tundra heath meadows and barrens occur at higher elevations.

Fauna. Bald eagles and marbled murrelets nest in forested areas on the islands and coastal mainland in this Section. Vancouver Canada geese nest and winter throughout southeast Alaska. Red-breasted sapsuckers, Pacific-slope flycatchers, golden-crowned kinglets, and red and white-winged crossbills are common breeders in the forests of this Section. Blue grouse are common throughout the area. Northern water shrews, deer mice, and long-tailed voles are commonly present. Porcupines are common on the mainland; river otters and mink are found throughout the Section. Marten were introduced to Baranof Island in 1934 and to Chichagof Island from 1949 through 1952. Red squirrels were introduced to these islands in 1930. Mountain goats occur on the mainland and were introduced to Baranof Island in 1923. Sitka black-tailed deer occur throughout the Section. Brown bear are present in high densities on Admiralty, Baranof, and Chichagof islands and in lower densities on the mainland. Black bears and gray wolves only occur on the mainland. Rough-skinned newts and boreal toads occur in this Section. King salmon are associated with the major mainland rivers. Pink salmon are the most numerous of the salmon species throughout the Section. Dolly varden are the most widely distributed resident fish.



View from Harbor Mountain near Sitka.

Climate. Average annual precipitation ranges from 70 to 220 in (1,780 to 5,590 mm). Average annual temperature ranges from 40 to 42 °F (4 to 6 °C). The growing season is from about May 1 to September 30. Killing frost can occur at any time in the higher elevations.

Surface Water Characteristics. The area has abundant precipitation and many small lakes and streams. Well-drained soils are generally at or near saturation most of the year. Most of the streams and river terminate in bays or estuaries; and fjords are rare. Wetlands occupy over 35 percent of the area.

Disturbance Regimes. Wildfire is rare, but landslides and avalanches occur abundantly. These disturbances keep vegetation in early seral stages along steeper valley walls. The outer islands are subject to intense winds from winter storms, causing much damage to forest stands.

Land Use. Human activity in the form of timber harvesting and road building is common on most of the islands, with the exception of Admiralty Island.

Cultural Ecology. This is the historic range of the Tlingit Indians.

Compiled by Alaska Region.

Section M245C–Southern Alexander Archipelago

Geomorphology. This Section includes all the islands below Fredrick Sound, as well as the mainland south of the Stikine River corridor below the permanent snowfields in southeast Alaska. Most of the area is rugged mountains with many broad, U-shaped, glaciated valleys which terminate as fjords at tidewater. Tidewater glaciers are infrequent in this Section. Elevation ranges from sea level to over 3,280 ft (1,000 m).

Lithology and Stratigraphy. The geology is very complex, consisting of volcanic islands and continental fragments of the Craig subterranean, Admiralty subterranean, and Taku terrane. Most rock types are Jurassic to Mesozoic deposits of sedimentary and volcanic rock types. Many of the assemblages have been metamorphosed, faulted, or folded, and the trending of most faults is northwesterly.

Soil Taxa. Predominant soils are Terric Cryohemists, Humic Cryorthods, Humic Lithic Cryorthods, and Andic Humicryods. Most of the soils on the steep slopes are formed in colluvial or landslide materials. Poorly drained depressions or low-lying areas are peatlands.

Potential Natural Vegetation. Coastal perhumid rain-forests of Sitka spruce and western hemlock predominate. The northern limits of western red cedar and salal corre-

spond to the northern boundary of this Section. Hydric vegetation of sphagnum moss, sedges, and willows predominate on peatlands. Some alpine heath meadows occur on the highest mountains.

Fauna. Bald eagles and marbled murrelets nest in forested areas on the islands and coastal mainland in this Section. Vancouver Canada geese nest and winter throughout southeast Alaska. Red-breasted sapsuckers, Pacific-slope flycatchers, golden-crowned kinglets, and red and white-winged crossbills are common breeders in the forests of this Section. Blue grouse are common throughout the area. Northern water shrews, deer mice, and long-tailed voles are commonly present. Porcupines are common on the mainland; river otters and mink are found throughout the Section. Marten were introduced to Prince of Wales Island in 1934. Mountain goats occur on the mainland and were introduced to Revillagigedo Island in 1983 and 1991. Sitka black-tailed deer occur throughout the Section. Rocky Mountain and Roosevelt elk were introduced to Etolin Island in 1987. Brown bear are present in low densities on the mainland, but not on the islands of this Section. Gray wolves and black bears are present throughout this area. Rough-skinned newts, northwest salamanders, long-toed salamanders, wood frogs, spotted frogs, and boreal toads occur in this Section. King salmon are associated with the major mainland rivers. Pink and silver are the most numerous salmon throughout the Section. Dolly varden are the most widely distributed resident fish.

Climate. Average annual precipitation ranges from 75 to 220 in (1,900 to 5,590 mm). Average annual temperature ranges from 42 to 46 °F (6 to 8 °C). The growing season lasts from about May 1 to September 30.

Surface Water Characteristics. The area has abundant precipitation and many small lakes and streams. Soils are generally at or near saturation most of the year. Most of the streams and rivers terminate in bays or estuaries, and fjords are common. Wetlands occupy 35 percent of the area.

Disturbance Regimes. Wildfire occurs only during drought periods. Landslides and avalanches are frequent on the steeper, intergorge walls, maintaining early successional communities. The outer islands are subject to extreme winds from winter storms. In turn, windthrow is common in forests along outer coasts.

Land Use. The presence of human activity in the form of timber harvesting and road building is common in most areas, except for the Misty Fjords National Monument.

Cultural Ecology. Both Tlingit and Haida Tribes reside here.

Compiled by Alaska Region.

Province 251–Prairie Parkland (Temperate)

Seven Sections have been delineated in this Province: 251A–Red River Valley; 251B–North-Central Glaciated Plains; 251C–Central Dissected Till Plains; 251D–Central Till Plains; 251E–Osage Plains; 251F–Flint Hills; and 251G–Central Loess Plains. These Sections are located in the north-central conterminous States, including parts of Oklahoma, Kansas, Nebraska, Missouri, Illinois, Indiana, Iowa, Minnesota, and North and South Dakota. The area of these Section is about 218,200 mi² (565,100 km²).

Section 251A–Red River Valley

Geomorphology. This Section is part of the Central Lowland geomorphic province. It forms the southern extension of a large, level lacustrine plain (Glacial Lake Agassiz) that extends far to the north and west into Manitoba, Saskatchewan, and Alberta. The plain is bisected by the Red River valley. Prominent alluvial fans formed where the Pembina and Sheyenne Rivers entered the glacial lake from the west. Beach and morainal ridges border the Section on the east. Other features include kettles, wetlands, and dunes adjacent to the fans. Drainage is a modified trellis pattern; tributaries enter the Red River from uplands to the east and west. Geomorphic processes operating in the Section are fluvial erosion, transport and deposition. Elevation ranges from 825 to 1,150 ft (250 to 350 m). Local relief is 3 to 25 ft (1 to 8 m).

Lithology and Stratigraphy. Pleistocene (Wisconsinan) till and lacustrine sand-silt-clay-peat-muck cover bedrock to a depth of 200 to 400 ft (60 to 120 m). Quaternary alluvium covers the lacustrine sediments in the fans and major river valleys. Bedrock is predominantly Archean granite, metasediments, and greenstone; Cretaceous shale and minor Jurassic sandstone overlap the Archean on the western and southern margins.

Potential Natural Vegetation. K  chler types are bluestem prairie and northern flood plain forest, with the latter mapped in a narrow strip along the Red River and its major tributaries.

Fauna. Historically there were large populations of bison, elk, and antelope. Large predators included the prairie wolf and grizzly bear. (This Section marked the easternmost range of both the grizzly bear and antelope). Other common species were the prairie chicken, sharptail grouse, prairie dog, and meadow lark. This area supported large numbers of both nesting and migrating waterfowl such as the mallard, pintail, greenwing teal, bluewing teal, and Cinnamon teal, canvasback and redhead ducks, as well as Canada and snow geese. Agriculture now dominates the Section; the major characteristic species are the

introduced ringneck pheasant, cottontail rabbit, jack rabbit, coyote, red fox, and a host of species adapted to small grain agriculture. white-tailed deer are very common in the wooded draws and riparian shrublands. The bison, elk, antelope, wolf, and grizzly bear have been extirpated. Prairie chicken, sharptail grouse, and the prairie dog survive only in scattered remnants of suitable habitat. Many of the original waterfowl species have been substantially reduced (pintail, mallard, teal, and canvasback) but others (Canada goose and sandhill crane) are faring well, largely due to waste grain residues in agriculture operations.

Climate. Precipitation averages 18 to 23 in (470 to 580 mm.). About 40 percent occurs during the growing season. Precipitation in winter is almost entirely snow. Mean annual temperature ranges from 36 to 45   F (2 to 7   C). The growing season lasts 111 to 136 days.

Surface Water characteristics. Drainage is to the Red River of the north, which dissects the Section, and flows to the north. Drainage network is minimally developed. Streams meander through the level topography. Most wetlands have been ditched and drained for agriculture. Flooding is common in early spring, often intensified by frozen conditions to the north, causing water to back up. There are few lakes; they are most common in the southeast on a till plain. Characteristically they are shallow and perched.

Disturbance Regimes. Fire, drought, and annual flooding are significant. High wind events are also common. Historically, bison grazing and ant activity caused important faunal modifications of vegetation and soils.

Land Use. The dominant land use is farming. Most wetlands have been drained for agriculture.

Cultural Ecology. Humans have occupied the area for at least 10,000 years, adapting their ways of life in a variety of changing environments. Conditions have ranged; from cool, wet, tundra supporting herds of open land grazing animals such as bison and caribou; through a warm, dry, savanna period when availability of water and aquatic resources was drastically altered; to the tall grass prairie of the present. People lived in small, nomadic groups and larger villages, changing their hunting, fishing, and gathering methods as environmental conditions changed, to enable the most efficient resource use. Horticulture has been practiced for about 1,000 years. Within the last 300 years, the near extinction of some species of fur-bearing mammals for the fur trade and cultivation of the land have significantly altered the

environment. Today, farming and recreation are the major human activities affecting the ecosystem.

Compiled by Eastern Region and Minnesota Department of Natural Resources.

Section 251B--North-Central Glaciated Plains

Geomorphology. This Section is part of the Central Lowland geomorphic province. It is mostly level to rolling till plain: A series of low, sub-parallel, south to north and southeast to northwest trending morainal ridges is featured in the northwestern third of the Section. The Coteau des Prairies, a moderately dissected, relatively high plateau with a much thinner till cover, is prominent in the northwestern portion. The Minnesota River's broad valley was created by the Pleistocene draining of Glacial Lake Agassiz. There are scattered lacustrine lowlands and outwash channels as well. Elevation ranges from 750 to 2,000 ft (225 to 600 m). Local relief is generally 20 to 100 ft (6 to 30 m); it is higher in a few localized areas, notably the edge of the Coteau des Prairies.

Lithology and Stratigraphy. Pleistocene till, stratified drift, and lacustrine sand and clay mantle virtually the whole Section, from 30 to 300 ft (9 to 90 m) thick; most is Wisconsinan, but Illinoian-Kansan covers the southwestern portion. A significant part of the area is capped with up to 20 ft (6 m) of Quaternary loess (aeolian silt). Quaternary alluvium fills the valley of the Missouri River and other major drainages. Cretaceous shale, limestone, and sandstone form bedrock across most of the west half of the Section and in isolated outliers farther east. These units lap onto Archean granite and gneiss to the north, and Devonian, Mississippian, and Pennsylvanian limestone and shale to the south. Small but significant outcrops of Proterozoic quartzite occur across the Section, where they cap paleo-topographic high points. The Paleozoic rocks are exposed intermittently in the deeper drainages.

Soil Taxa. Types are mostly Mollisols, with some Alfisols and Entisols. Temperature regimes are mostly mesic, with some frigid in the north. Moisture regimes are mostly udic, with some aquic and some ustic. Well-drained to moderately well-drained loamy soils formed in gray calcareous till of Des Moines lobe origin are dominant.

Potential Natural Vegetation. Küchler type is mapped as almost entirely bluestem prairie, with a narrow corridor of northern flood plain forest along the Minnesota River, and a few fingers of oak-hickory forest along other drainages in the southern part.

Fauna. Historically there were large populations of bison, elk, and antelope. The major large predator was the prairie wolf. Other common species were the prairie chicken, sharptail grouse, prairie dog, and meadow lark. This was "pothole" country - areas of small, saucer-shaped wetlands. It supported large numbers

of both nesting and migrating waterfowl, such as the mallard, pintail, greenwing, bluewing and Cinnamon teal, canvasback, and redhead ducks, as well as Canada and snow geese. Agriculture now dominates the Section; and the major characteristic species are the introduced ringneck pheasant, cottontail rabbit, jack rabbit, coyote, red fox, and a host of species adapted to small grain agriculture and woodlands. white-tailed deer are very common in the wooded draws and riparian shrublands. The gray squirrel is common in woodlands, and recently the wild turkey has substantially increased as a result of re-introductions. The bison, elk, antelope, and wolf have been extirpated. Prairie chicken, sharptail grouse, and the prairie dog survive only in scattered remnants of suitable habitat. Many of the original waterfowl species have been substantially reduced (pintail, mallard, teal, and canvasback) but others (Canada goose and sandhill crane) are faring well, largely due to waste grain residues in agriculture operations.

Climate. Annual precipitation averages 20 to 33 in (500 to 850 mm). About half falls during the growing season. Mean annual temperature is about 40 to 48 °F (5 to 9 °C). The growing season lasts 120 to 160 days

Surface Water Characteristics. Drainage is to the Mississippi via the Minnesota, Big Sioux, Des Moines, and Missouri Rivers. The drainage network is well established in the western part. The eastern part has relatively low frequency of shallow drainages. Natural lakes are rare, except in the Des Moines lobe in the eastern part. Many of these lakes tend to be shallow and perched. Small, saucer-shaped wetlands called prairie potholes were common, especially across the western part of this Section. Most wetlands have been drained for agriculture.

Disturbance Regimes. Historically, fire was the most common natural disturbance. Floods and tornadoes also occurred. Fire suppression has allowed woodlands to develop from what was originally oak openings or brush prairies.

Land Use. Current land use is dominantly agriculture.

Cultural Ecology. Humans have occupied the area for at least 10,000 years, adapting their ways of life in a variety of changing environments. Conditions have ranged; from cool, wet, tundra supporting herds of open land grazing animals such as bison and caribou; through a warm, dry, savanna period when availability of water and aquatic resources was drastically altered; to the tall grass prairie of the present. People lived in small, nomadic groups and larger villages, changing their hunting, fishing, and gathering methods as environmental conditions changed, to enable the most efficient resource use. Horticulture has been practiced for about 1,000 years. Within the last 300 years, the near extinction of some species of fur-bearing mammals for the fur trade and cultivation of the land have significantly altered the environment. Today, farming and recreation are the major human activities affecting the ecosystem.

Section 251C—Central Dissected Till Plains

Geomorphology. This is part of the Central Lowland geomorphic province. It is characterized by moderately dissected, glaciated, flat-to-rolling plains that slope gently toward the Missouri and Mississippi River valleys, which bracket the Section on the west-south and east, respectively. Local relief is 20 to 165 ft (6 to 50 m). A minor anthropogenic landform, strip-mined areas exhibit hummocky or ridge-swale topography. Drainage is dendritic; current geomorphic processes are fluvial erosion, transport and deposition, and minor mass wasting. Elevation ranges from 600 to 1,500 ft (185 m).

Lithology and Stratigraphy. Quaternary loess (unconsolidated aeolian silt), as much as 25 ft (8 m) thick and thinning to the east, mantles most uplands. Pleistocene (pre-Illinoian) till and stratified drift underlie the loess and cover most bedrock up to 300 ft (90 m) deep, thinning to less than 30 ft (9 m) to the east and south. The Mississippi and Missouri flood plains have up to 150 ft (45 m) of unconsolidated Tertiary and Quaternary alluvium (gravel, sand, silt, and clay)

overlying bedrock; other river valleys across the Section have somewhat less alluvial fill. Isolated outliers of Cretaceous shale and sandstone occur beneath the drift in the northwestern corner of the Section; Permian sandstone forms bedrock along the western margin; Pennsylvanian shale, limestone, and minor coal underlie most of the Section; and Mississippian, Devonian and Ordovician shale and carbonate form bedrock to the east and south. Bedrock is exposed locally along the deeper drainages and in “windows” eroded through the unconsolidated surficial material.

Soil Taxa. Types are mostly Mollisols, some with claypan, with lesser extent of Alfisols. Moisture regime is mostly udic, with some aquic. Temperature regime is mesic. Minerology is montmorillonitic or mixed. Soils are generally deep, rich, and dark-colored.

Potential Natural Vegetation. Küchler vegetation types are mapped as dominantly mosaic of bluestem prairie and oak-hickory forest, with oak-hickory forest along drainage ways. An estimated 60 percent of the land surface was bluestem (tall grass) prairie, with bur oak and white oak savannas interspersed and in transitional areas. Upland forest (white oak-shagbark hickory) occurred on more dissected land, grading into bottomland forests along rivers.



A characteristic rolling landscape of the Central Dissected Till Plains Section.

Fauna. Prairie animals are now uncommon, since fewer than 20 natural prairies remain, all less than 20 acres in size. The major ungulates were bison and elk, which have been extirpated; white-tailed deer and cattle are prevalent today. The major predator is coyote (wolves and cougar were extirpated). Raccoon, badger, skunk, rodent. Open lands birds like hawks, bobwhite quail, meadowlarks, sparrows, swallows are numerous; there are also savanna and woodland species such as turkey, and warblers. The numbers of prairie chicken, already low, declined recently. Introduced ring-necked pheasant are common. There are moderate numbers of reptiles and amphibians.

Climate. Mean annual precipitation is 30 to 40 in (760 to 1,020 mm). About two-thirds of this amount occurs during the growing season. Most winter precipitation is snow. Mean annual temperature is 50 to 56 °F (10 to 13 °C). The growing season lasts 160 to 180 days.

Surface Water Characteristics. A well developed and integrated dendritic drainage network is carved into the land surface. Natural lakes and ponds are rare or non-existent. Many streams that formerly meandered across broad valleys now are straightened by channelization and silted-in from agricultural run-off.

Disturbance Regimes. Fire and grazing by herds of bison and elk were most important in creation and maintenance of this landscape.

Land Use. Nearly all of this area is used for agriculture. About one-half is tilled crop land; the rest is used for haying or pasture.

Cultural Ecology. Ten thousand years ago, the river valleys of the Missouri and Mississippi were choked with floods from heavy rainfall and the outwash of northern glaciers. Interglacial periods were marked by dust storms. As the glaciers retreated, the Missouri River and its tributaries became a network of routes for water-traveling people to and from Missouri in any direction. Three thousand years ago there was widespread interaction among groups located along the Tennessee and Lower Mississippi Rivers. Two thousand years ago, people lived in villages located near the mouth of tributary rivers. One thousand years later, Cahokia, a major population center, existed with full-scale agriculture. The Missouri tribe continued agriculture and hunting and gathering until European settlement, when use of fire was discouraged to increase forest cover, grassland was converted for agricultural use, and strip mining for coal became prominent.

Compiled by Eastern Region and Missouri Department of Conservation.

Section 251D—Central Till Plains

Geomorphology. This Section is part of the Central Lowlands geomorphic province. It is a level to gently rolling till-plain (glacial ground moraine), with broad bottomlands and associated terraces and meander scars along major river valleys. The plain is overlain by a series of low, undulating ridges (glacial end moraines). Relief along flood plain margins of major rivers and their larger tributaries can exceed 150 ft (45 m). A notable but minor landform is anthropogenic. lands that have been strip-mined exhibit hummocky or ridge-swale topography. The dominant geomorphic processes operating in the Section are fluvial erosion, transport and deposition, with minor mass wasting. Elevation ranges from 600 to 1,000 ft (180 to 300 m). Local relief is dominantly 3 to 100 ft (1 to 30 m), but ranges up to 165 ft (50 m) along bedrock bluffs along some major streams.

Lithology and Stratigraphy. Section 251D is almost entirely covered by Pleistocene till and stratified drift up to 400 ft (120 m) thick. The tills are of Kansan, Illinoian, and Wisconsinan age (oldest to youngest, exposed west to east). Up to 25 ft (8 m) of loess cover till and bedrock on bluffs overlooking the Mississippi's flood plain; the loess thins to the east. Wisconsinan lacustrine deposits (stratified silt, clay, peat, and muck) occur along some rivers and tributaries and between moraines in the northeastern part of the Section. Bedrock beneath the drift is composed of lower Mississippian limestones, shales, and sandstones, well exposed on the uplands between the lower Illinois River and the Mississippi's flood plain, and in the bluffs overlooking the rivers. Silurian and Devonian carbonates crop out along the flood plain margins farther north. Mississippian and Pennsylvanian limestones, siltstones, and sandstones are exposed in erosional "windows" through the till along the Wabash and its major tributaries.

Soil Taxa. Types are mostly Udolls and Aquolls, with mesic temperature regime. Moisture regimes are udic and aquic. Soils tend to have relatively thick surface layers, darkened by decomposed organic matter. They are very productive for agricultural crops.

Potential Natural Community. This area is principally tall grass prairie. variations on the big bluestem-indiangrass-prairie dropseed-switchgrass community; cord grass-sedge-blue jointgrass communities on wet sites; and little bluestem-side oats-grama on drier sites. Forest communities occur along stream valleys. white oak-black oak-shagbark hickory community on slopes, with basswood-sugar maple-elm-ash community on wetter, shaded sites. Küchler mapped the area as oak savanna and oak-hickory forest.

Fauna. Elk and bison, once preyed upon by the prairie wolf and coyote, disappeared from the area in the early 1800's. The wolf disappeared from the Section in the late 1860's leaving only the coyote and bobcat to prey



View west across Scott County, Illinois, toward the Illinois River flood plain during the Great Flood of 1993. Mauvaise Terre Creek crosses the upper right corner, bounding oak-hickory forest-covered uplands, which were low sand dunes during the Pleistocene. Characteristic plains crop lands occupy the foreground.

upon small mammals such as the masked shrew, meadow vole, and western harvest mouse, which are common here today. Avian species such as the black-capped chickadee, northern harrier, upland sandpiper, long-eared owl, and Henslow's sparrow occupy the forest and grasslands; sora, black-crowned night herons, and the veery are found in the sedge meadows and swamps. The Illinois chorus frog, Kirtland's snake, the Plains leopard frog, and Illinois mud turtle typify present day herptofauna. The yellow perch, striped shiner, silver jaw shiner, quiltback and silver redhorse are found in the major rivers and their tributaries.

Climate. Precipitation averages 29 to 35 in (750 to 900 mm). Two-thirds of this amount falls during the growing season. Temperature averages 46 to 54 °F (8 to 12 °C). The growing season lasts 160 to 180 days.

Surface Water Characteristics. There is a relatively low frequency of shallowly entrenched, slow-flowing, meandering streams. A few small marshes and prairie potholes remain.

Disturbance Regimes. Historically, major natural disturbances were prairie fires and grazing ungulates. Since settlement, most of the wetlands, marshes, and "prairie potholes" have been drained for agriculture, and virtually all prairie habitats have been replaced with row crops or pasture.

Land Use. This is highly productive agricultural land. Current land use is almost entirely agricultural, with associated roads, towns, and villages; minor coal and aggregate mining, and oil and gas production occur.

Cultural Ecology. Prehistoric populations generally occupied the major river valleys; their subsistence and tool technologies relied on forest edge, riparian, aquatic and prairie habitats. Transportation and settlement were largely restricted to the major waterways. Population numbers continued to increase throughout prehistory; the pressure caused the most recent prehistoric (400 to 1450 A.D.) and historic (about 1450 to 1840) Native American groups to expand into the prairie interior. Early 19th century Euro-American settlement was also generally restricted to the major river valleys. Completion of the Illinois-Michigan Canal and the Illinois Central Railroad by the mid-1800's funneled increasing numbers of European immigrants into unsettled areas of the prairie. New technology and innovation enabled settlers to drain the extensive prairie wetlands (remnants of broad, shallow glacial lakes) and bring the black prairie soils into cultivation. This land is some of the most fertile and, therefore, most valuable land in the midwestern farm belt. It is the most densely populated rural region in Illinois, and has the highest per capita income of agricultural areas in the State.

Compiled by Eastern Region and The Nature Conservancy, Illinois Chapter.

Section 251E—Osage Plains

Geomorphology. This is part of the Central Lowlands geomorphic province. It is characterized by a series of sub parallel, southwestern to northeastern trending, maturely dissected, low cuestas or escarpments separating level to gently rolling plains. Local relief on the cuestas is generally between 100 and 300 ft (30-90 m); on the plains it is less than 100 ft. Elevation ranges from 300 to 1,300 ft (100 to 400 m).

Lithology and Stratigraphy. Quaternary loess and residuum blanket this Section. Bedrock is composed almost entirely of Pennsylvanian shale, limestone, and sandstone; sandstones and cherty limestones support the cuestas. Some Permian shale and limestone occur in the northwestern corner of the Section.

Soil Taxa. This Section has about 70 percent Mollisols, with 20 percent Alfisols in the northeast area bordering the Ozark Highlands Section, and 10 percent Ultisols to the south. Soils have a mesic to thermic temperature regime, a udic or aquic moisture regime, and mixed mineralogy. Soils are moderately fertile but shallow enough to prevent tilling throughout most of the section.

Potential Natural Vegetation. Küchler vegetation types are mapped as dominantly mosaic of bluestem prairie and oak-hickory forest, with corridors of oak-

hickory forest along drainage ways. This section was once 70 percent tall grass prairie, little bluestem and associates, with groves of post and blackjack oaks. Upland prairie graded into wet bottomland prairie, with sloughs, marshes, and mixed bottomland forest. The forest included silver maple, green ash, cottonwood, pecan, pin oak, and bur oak.

Fauna. Habitat includes relatively large surviving prairie fragments, some over 1,000 acres. Cattle replaced elk and bison (the latter are being re-introduced under domestication). White-tailed deer are abundant. Large predators were extirpated, except for coyote. Birds include hawks, turkey vulture, bobwhite quail, meadowlark, scissor-tailed flycatcher, dickcissel, and sparrows.

Climate. Mean annual precipitation ranges from 35 to 41 in (900 to 1,050 mm). Snow averages about 5 in (120 mm). Mean annual temperature ranges from 55 to 63 °F (13 to 17 °C). The growing season lasts 190 to 235 days.

Surface Water Characteristics. This Section has a moderate density of small to medium size, highly meandering, perennial and intermittent streams with dendritic drainage pattern. Most streams have a low to moderate rate of flow and moderate velocity. Large seasonal fluctuations in discharge of streams; i.e., June's maximum may be six times greater than December's



Unglaciated landscape of the Osage Plains with remnant tall grass prairie growing on thin soils over bedrock.

minimum. Waters may stand for three months or longer in wide, flat flood plains. There are a few oxbows; some large rivers have been dammed to create reservoirs.

Disturbance Regimes. Fire, grazing, drought (occasionally very severe), and tornadoes were the principal prehistoric sources of disturbance.

Land Use. Cattle production is a common use. Native vegetation has been converted to fescue pasture and agricultural crops on about 75 percent of the area.

Cultural Ecology. Glacial dust blown from the north enriched valley soils, supporting a thick blanket of vegetation. By 10,000 years ago, small, mobile groups of humans populated the area. Seven thousand years ago, these groups continued hunting smaller game and gathering a wider variety of plant resources. One thousand years ago, the residents settled down to grow crops and hunt buffalo. Slash-and-burn agriculture was practiced. This pattern continued until the arrival of European-Americans.

Compiled by Eastern Region and Missouri Department of Conservation.

Section 251F—Flint Hills

Geomorphology. Relatively old episodes of Paleozoic platform sedimentation were followed by uplift and dissection, characteristic of geomorphic processes historically active in this Section. Present geomorphic processes include gentle and moderate gradient valley stream erosion, transport and deposition. Gentle sloping hills with relief of 300 to 500 ft, found among lowlands, make up most of the area. This Section is within the Central Lowlands geomorphic physical province. Elevation ranges from 985 to 1,970 ft (300 to 600 m).

Lithology and Stratigraphy. Most of the Section is interbedded Pennsylvanian carbonates and shales with recent alluvium in the major river valleys. The northeastern quarter of the Section is Quaternary glacial till, lacustrine, and fluvial deposits.

Soil Taxa. Types include mostly Mollisols, with 20 percent in Inceptisols along hilly terrain in the southeastern area of the Section. Soils have a mesic or thermic temperature regimes, a ustic moisture regime, and mixed mineralogy.

Potential Natural Vegetation. There is bluestem prairie with northern flood plain forest along major drainages.

Fauna. Bison and pronghorn antelope were once numerous in this Section. White-tailed deer are now the most common large mammal. Smaller mammals include jack rabbits, cottontails in areas of streams and

cover, and many smaller rodents. Coyotes, red foxes, and bobcats are mammalian predators. Bobwhites, horned larks, and meadowlarks are present in large numbers. Cooper's hawks, red-tailed hawks, and barred owls are year-round residents. Purple martins and swallows are summer nesters. The Section is at the northern end of winter range for gadwalls, green-winged teals, and lesser scaups. Herpetofauna include snapping turtles, bullfrogs, ringneck snakes, and bull snakes. Catfish species are common in rivers and lakes, along with largemouth bass and black crappie.

Climate. Precipitation averages 24 to 35 in (620 to 900 mm). Temperature averages 50 to 61 °F (10 to 16 °C). The growing season lasts 160 to 190 days.

Surface Water Characteristics. There is a low density of small to medium size intermittent and perennial streams and associated rivers, mostly with low to moderate rates of flow and moderate velocity. Dendritic drainage pattern has developed on maturely dissected surfaces, largely without bedrock structural control. Few natural lakes occur.

Disturbance Regimes. Fire and drought have probably been the principal historical sources of disturbance.

Land Use. Land use has caused conversion from native vegetation to agricultural crops on about 75 percent of the area.

Cultural Ecology. Reserved.

Compiled by Rocky Mountain Region.

Section 251G—Central Loess Plains

Geomorphology. Dissected loess plains comprise this Section. It has gently rolling smooth, and irregular plains mantled by loess. Drainage pattern cuts into upper loess mantle and exposes older Loveland loess. Stream valleys are narrow, not deeply incised. Local relief ranges from tens to hundreds of ft. This Section is in the Central Lowlands and Great Plains geomorphic provinces. Elevation ranges from 600 to 1,970 ft (183 to 600 m).

Lithology and Stratigraphy. The Section is predominantly Quaternary glacial till, lacustrine, and fluvial deposits, with local windblown dune sand and loess. In the extreme southwest part of the Section is an area of Paleozoic carbonates and shales.

Soil Taxa. Types include dry Mollisols and Entisols, Mesic Ustolls, and Udolls. Entisols, Mollisols, and Alfisols with udic and aquic moisture regimes occur along major drainages.

Potential Natural Vegetation. There is bluestem prairie with northern flood plain forest along major drainages.



Much of the native vegetation has been cleared for agricultural crops in the Central Loess Plains Section of eastern Nebraska.

Fauna. Bison were once present in great numbers, and pronghorn antelope extended their eastern range through this Section. White-tailed deer are now the most common large mammal. Smaller mammals include jack rabbits, cottontails, opossum, and many small rodents. Swift foxes, kit foxes, bobcats, and coyotes are predators. Bobwhites, horned larks, and meadowlarks are plentiful. Cooper's hawks, barred owls, and long-eared owls are year-round residents. Herpetofauna include snapping turtles, box turtles, bullfrogs, ringneck snakes, and bull snakes. Catfish species, largemouth bass, and black crappie are typical fish of the area.

Climate. Precipitation averages 25 to 35 in (630 to 900 mm). Temperature averages 46 to 57 °F (8 to 14 °C). The growing season lasts 150 to 190 days.

Surface Water Characteristics. The Platte, Republican, Big Blue, and Little Blue Rivers flow through this Section. Hard groundwater is abundant in sand and

gravel, but is scarce in areas where shale and clay are near the surface. Two sizable reservoirs in the area are Turtle Creek and Milford. There is a relatively low frequency of shallowly entrenched, slow flowing, meandering streams. Also characteristic of this area are small marshes and prairie potholes, many of which have been drained.

Disturbance Regimes. Drought and fire are probably the principal sources of disturbance.

Land Use. This area is highly productive farmland; about 60 percent is in crops and about 25 percent is used for grazing. Irrigation by wells and canals is common in the north. Most of the small marshes and prairie potholes were drained for agricultural uses.

Cultural Ecology. Reserved.

Compiled by Rocky Mountain Region.

Province 255–Prairie Parkland (Subtropical)

Four Sections have been delineated in this Province: 255A–Cross Timbers and Prairie; 255B–Blackland Prairies; 255C–Oak Woods and Prairies; and 255D–Central Gulf Prairies and Marshes. These Sections are located in Oklahoma and Texas. The area of these Sections is about 80,100 mi² (207,500 km²).

Section 255A–Cross Timbers and Prairies

Geomorphology. This Section is in the Central Lowlands geomorphic province. The predominant landform on about 70 percent of the Section consists of irregular plains that originated from uplift of level bedded continental sediments, that had been deposited into a shallow inland sea, followed by a long period of erosion. Other landforms include plains with hills and open high hills. Elevation ranges from 330 to 1,300 ft (100 to 400 m). Local relief ranges from 100 to 300 ft (30 to 90 m).

Lithology and Stratigraphy. Rock units were formed during the Paleozoic (30 percent) and Mesozoic (70 percent) Eras. Paleozoic strata consist of Pennsylvanian marine deposits (sandstone, shale, coal, and limestone). Mesozoic strata consist of Lower Cretaceous marine deposits (limestone).

Soil Taxa. Soils in the Cross Timbers region are mainly Ustalfs. Paleustalfs and Haplustalfs are on uplands. Ustifluvents and Haplustolls are on narrow flood plains. Soils have a thermic temperature regime, a ustic moisture regime, and mixed or siliceous mineralogy. Soils are deep, well drained, and moderate textured; moisture is limited for use by vegetation during part of the growing season. Soils in the Prairie region are Ustolls, Userts, and Ochrepts. Pellusterts and Chromusterts are on upland valleys. Calciustolls are on smooth uplands. Haplustolls, Calciustolls, and Argiustolls are on areas of limestone



Viewed from a cuesta in central Texas, east of Abilene, predominant vegetation consists of midgrasses, juniper, mesquite, and blackjack, and post oaks. Other cuestas are visible on the horizon. Reduced precipitation causes trees to be short and shrubby.

parent material. Ustochrepts and Calciustolls occur on steep plateau sideslopes. Haplustolls are on flood plains. Argiustolls and Haplustalfs are on smooth uplands in northern areas of the Section. Soil temperature regime is thermic, moisture regime is ustic, and mineralogy is montmorillonitic, mixed, or carbonatic. Generally, soils are deep, fine textured, and well drained; moisture is limited for use by vegetation during parts of the growing season.

Potential Natural Vegetation. Küchler classified vegetation as cross timbers (*Quercus-Andropogon*), oak-hickory forest, and oak-hickory-pine forest. The predominant vegetation form is cold-deciduous broad-leaved forest and extensive areas of tall grassland with a tree layer. Forest cover consists of post, live, and blackjack oaks, and pignut and mockernut hickories. Grasses consist of big and little bluestems, indiagrass, and sunflower.

Fauna. Among the fauna in this Section are white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, eastern chipmunk, white-footed mouse, pine vole, short-tailed shrew, and cotton mouse. The turkey, bobwhite, and mourning dove are game birds in various parts of this Section. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake and timber rattlesnake.

Climate. Precipitation averages 35 to 40 in (900 to 1,050 mm). About 5 to 18 in (120 to 450 mm) of snow falls annually. Temperature averages 55 to 63 °F (13 to 17 °C). The growing season lasts 190 to 235 days.

Surface Water Characteristics. This Section has a low to moderate density of perennial streams and associated rivers, mostly with low to moderate rates of flow and moderate velocity. Dendritic drainage patterns have developed. One of the major rivers draining this Section is the Red. A relatively large number of water reservoirs have been constructed.

Disturbance Regimes. Fire and drought have probably been the principal historical sources of disturbance.

Land Use. Natural vegetation has been cleared for agricultural crops on about 75 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region.

Section 255B—Blackland Prairies

Geomorphology. This Section is in the Coastal Plains geomorphic province. The predominant landform is irregular plains. This Section is an elevated sea bottom that has been shaped by marine and shore-zone processes resulting from repeated episodes of submergence and

emergence of the land from the ocean. Some geomorphic processes currently active throughout the area are gentle gradient valley stream erosion, transport and deposition. Elevation ranges from 330 to 660 ft (100 to 200m). Local relief ranges from 100 to 300 ft.

Lithology and Stratigraphy. Rock units in this Section formed during the Mesozoic (10 percent) and Cenozoic (90 percent) Eras. Mesozoic strata consist of Upper Cretaceous marine deposits (shales, marls, and chalks). Cenozoic strata consists of Tertiary marine deposits.

Soil Taxa. Soils are Usterts, Ustolls, Aqualfs, and Ustalfs. Pellusterts are in upland valleys. Chromusterts are on eroded uplands. Haplustolls and Ustorthents are along an Austin chalk escarpment. Calciustolls and Haplustolls are along stream terraces. Albaqualfs, Ochraqualfs, and Paleustalfs are on uplands. Pelluderts, Haplaquolls, and Chromusterts are on flood plains. These soils have a thermic temperature regime, a ustic or aquic moisture regime, and montmorillonitic or mixed mineralogy. Generally, soils are deep, mostly well drained, medium to fine textured, and have limited soil moisture supplies for use by vegetation during parts of the growing season.

Potential Natural Vegetation. Küchler mapped vegetation as blackland prairie (*Andropogon-Stipa*) and juniper-oak savanna. The predominant vegetation form is tall grassland consisting mainly of bunch grasses, such as indiagrass, big bluestem, switchgrass, and eastern gamagrass. A savanna community occurs along many major rivers, consisting of elm, pecan, cottonwood, and hackberry, with grasses between the trees.

Fauna. Faunal communities are characterized by species associated with a prairie climate and vegetation. Typical large herbivores and carnivores include coyote, ringtail, and collared peccary. Smaller herbivores include plains pocket gopher, fulvous harvest mouse, and northern pygmy mouse. Ocelots were once common, but are now rare. The bison is historically associated with the Section. Birds are typical of grass and shrublands; residents include many common species, such as turkey vulture, hairy woodpecker, cardinal, and yellow warbler. Smith's longspur, a bird of the Arctic tundra, winters here. Amphibians and reptiles typical of this area include eastern spadefoot toad, Great Plains narrow-mouthed frog, green toad, Texas toad, Gulf Coast toad, yellow mud turtle, Texas horned lizard, Texas spiny lizard, and Texas blind snake.

Climate. Precipitation ranges from 30 to 45 in (750 to 1,150 mm), occurring mainly in spring from April through May. Temperature averages 63 to 70 °F (17 to 21 °C). The growing season lasts 230 to 280 days.

Surface Water Characteristics. Reserved.

Disturbance Regimes. Fire and drought have probably been the principal historical sources of disturbance.

Land Use. Natural vegetation has been changed to agricultural crops on about 75 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region.

Section 255C—Oak Woods and Prairies

Geomorphology. This Section is in the Coastal Plains geomorphic province. The predominant landform on about 80 percent of the Section consists of irregular plains. Other landforms include plains with hills and smooth plains. This Section is an elevated sea bottom that has been shaped by marine and shore-zone processes resulting from repeated episodes of submergence and emergence of the land from the ocean. Some geomorphic processes currently active throughout the area are gentle gradient valley stream erosion, transport and deposition. Elevation ranges from 650 to 1,310 ft (200 to 400 m). Local relief ranges from 100 to 300 ft.

Lithology and Stratigraphy. Rocks units formed during the Cenozoic Era. Strata are Tertiary marine sediments consisting of glauconitic, calcareous, fossiliferous strata with lignitic sandy and argillaceous deposits.

Soil Taxa. Soils are mostly Ustalfs. Paleustalfs and Albaqualfs are on uplands and other areas with thick sandy surface. Pelluderts, Pellusterts, and Hapludolls are on flood plains and clayey terraces along major rivers. These soils have a thermic temperature regime, an ustic moisture regime, and montmorillonitic mineralogy. Soils are deep, medium textured, and generally have a slowly permeable, clayey subsoil. Moisture may be limiting for plant growth during parts of the year.

Potential Natural Vegetation. Küchler classified vegetation as oak-hickory forest, cross timbers (*Quercus-Andropogon*), and juniper-oak savanna. The predominant vegetation type is cold-deciduous, broad-leaved forest. The oak-hickory cover type consists of scarlet, post, and blackjack oaks, and pignut and mockernut hickories. Forests of elm, pecan, and walnut are in bottomlands. Little bluestem is the dominant grass.

Fauna. Faunal communities are characterized by species associated with a temperate, subhumid, forested environment. Common large herbivores and carnivores include coyote, ringtail, ocelot, and collared peccary. Smaller herbivores include plains pocket gopher, fulvous harvest mouse, northern pygmy mouse, southern short-tailed shrew, and least shrew. Jaguar and bison are historically associated with this Section. Birds typical of this Section include many wide-spread species, such as eastern bluebird, eastern meadowlark, grasshopper sparrow, mourning dove, Cooper's hawk, and mockingbird. Amphibians and reptiles include eastern spadefoot toad, Great Plains narrow-mouthed frog, green toad, yellow mud turtle, Texas horned lizard, Texas spiny lizard, and Texas blind snake.

Climate. Annual precipitation ranges from 27 to 40 in (700 to 1,000 mm). Temperature ranges from 63 to 70 °F (17 to 21 °C). The growing season lasts 200 to 260 days.

Surface Water Characteristics. There is a low density of small to medium size perennial streams and associated rivers, most with moderate volume of water flowing at low velocity. A major river draining this Section is the Trinity.

Disturbance Regimes. Fire and drought have probably been the principal historical disturbances.

Land Use. Natural vegetation has been converted to agricultural crops on about 75 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region.

Section 255D—Central Gulf Prairies and Marshes

Geomorphology. This Section is in the Coastal Plains geomorphic province. The predominant landform consists of a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto a submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore-zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation ranges from sea level to 160 ft (0 to 50 m). Local relief ranges from 0 to 100 ft.

Lithology and Stratigraphy. Rock units formed during the Cenozoic Era. Strata consist of Quaternary marine deposits (non-glacial sand, silt, and clay deposits) of continental origin.

Soil Taxa. Soils are Aquepts, Aqualfs, Aquolls, and Aquepts. Psammaquepts, Udipsamments, Fluvaquepts, and Salorthids are on barrier islands and long bays. Haplaquolls, Natraqualfs, Pelluderts, and Pellusterts are on low coastal terraces. Ochraqualfs, Albaqualfs, and Paleudalfs are found on plains. Haplaquolls, Haplaquepts, and Fluvaquepts are on coastal flats and flood plains. These soils have a hyperthermic and thermic temperature regime, an aquic moisture regime, and montmorillonitic, mixed, or siliceous mineralogy. Soils are fine to coarse textured, saline, and mostly poorly drained with high water tables.

Potential Natural Vegetation. Küchler classified vegetation as bluestem-sacahuista prairie and southern cordgrass prairie. The predominant vegetation form is tall grassland consisting mainly of bunch grasses. Prairie grasslands dominate areas inland from the coast and consist of little bluestem, indiagrass, switchgrass, and big bluestem. Occasional areas of live oak are present. Poorly drained areas along the coast support freshwater and

saltwater marsh vegetation of sedges, rushes, saltgrass, and cordgrass.

Fauna. Large to medium size herbivores and carnivores include coyote, ringtail, hog-nosed skunk, river otter, ocelot, and collared peccary. Smaller herbivores include swamp rabbit, plains pocket gopher, fulvous harvest mouse, northern pygmy mouse, and nutria. Bison and jaguar are historically associated with this Section. Birds of fresh water marshes, lakes, ponds, and rivers include reddish egret, white-faced egret, white-fronted goose, and olivaceous cormorant. Birds of these grassland include white-tailed hawk, bronzed cowbird, and Attwater's prairie chicken. The rare whooping crane winters in this Section at the Aransas National Wildlife Refuge. Reptiles include American alligator, Gulf coast salt marsh snake, Mediterranean gecko, keeled earless lizard, Texas horned lizard, Texas spiny lizard, and Texas blind snake. Amphibians common to this Section include Gulf coast toad and diamondback terrapin.

Climate. Annual precipitation ranges from 25 to 55 in (620 to 1,400 mm). Temperature averages 68 to 70 °F (20 to 21 °C). The growing season lasts 280 to 320 days.

Surface Water Characteristics. There is a moderate density of small to medium size perennial streams and a low density of associated rivers, most with moderate volume of water flowing at very low velocity. The water table is high in many areas, resulting in poor natural drainage and abundance of wetlands. A poorly defined drainage pattern has developed on very young plains. An abundance of palustrine systems are present, having seasonally high water level. This Section adjoins the Carolinian and Louisianian Marine and Estuarine Provinces.

Disturbance Regimes. Ocean tides have probably been the principal historical disturbance. Climatic influences include occasional hurricanes.

Land Use. Natural vegetation has been converted to agricultural crops on about 40 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region.

Province 261—California Coastal Chaparral Forest and Shrub

Two Sections have been delineated in this Province: 261A—Central California Coast; and 261B—Southern California Coast. These Sections are located along coastal California. The area of these Sections is about 10,300 mi² (26,700 km²).

Section 261A—Central California Coast

Geomorphology. This area includes parallel ranges and valleys on folded, faulted and metamorphosed strata; there are rounded crests of subequal height. This Section is in the Coast Ranges geomorphic province. Elevation ranges from sea level to 2,400 ft (0 to 730 m).

Lithology and Stratigraphy. Types include Cenozoic marine and nonmarine sedimentary rocks and alluvial deposits, and Mesozoic granitic and ultramafic rocks.

Soil Taxa. Dominant soils are Alfisols, Entisols, Histisols, Inceptisols, Mollisols, Ultisols, and Vertisols, in combination with isomesic, mesic, or thermic soil temperature regimes and xeric or udic soil moisture regimes.

Potential Natural Vegetation. Küchler mapped vegetation as mixed hardwood forest, coastal prairie-scrub, coastal sagebrush, mixed hardwood and redwood forest, redwood forest, and southern oak forest. Predominant potential natural communities are Coastal Sage (Lucian), Coast Live Oak, Coastal Perennial Grassland and Redwood (northern part) series.

Fauna. This Section includes a variety of coastal, marsh, estuary, wetland, riparian, grassland, shrubland, oak savanna, and broadleaf and conifer forest communities. Mammals include mule deer, bobcat, weasel, fox, skunk, opossum and ground squirrel. Turkey vultures, hawks, owls, herons, egrets, flycatchers, swallows, and ravens are common birds. Birds of concern include the brown pelican, lesser tern, osprey, black rail, clapper rail, marbled murrelet, spotted owl, and bank swallow. Reptiles and amphibians include the western rattlesnake, common and western aquatic garter snakes, northern and southern alligator lizards, and several species of salamanders and frogs. Marine and shore species include sea otter, sea lions, seals, brown pelicans, gulls, cormorants, terns, and various shore birds. Introduced species include small populations of fallow deer and barbary sheep. Feral hogs are common throughout large portions of the Section.

Climate. Precipitation ranges from 14 to 50 in (350 to 1,270 mm). Temperature averages 50 to 63 °F (10 to 17 °C). Summer daytime temperatures often are modified by

morning fog and sea breezes. The growing season lasts 200 to 330 days.

Surface Water Characteristics. Several slow moving, tide-affected major rivers in alluvial channels terminate in San Francisco and Monterey Bays. Much of the saltwater marshes on the north and south ends of San Francisco Bay are converted to salt evaporation ponds. A few slow moving perennial streams in alluvial or weak bedrock channels flowing directly to the Pacific Ocean occur in the northern part of the area. Some fast moving perennial streams in weak bedrock channels flowing directly to the Pacific Ocean occur in the southern part of the area. Reservoirs for municipal water supply are common in the northern part of the Section.

Disturbance Regimes. Fires are of variable frequency, season, and intensity. This is a seismically active area with strong shaking and ground rupture.

Land Use. Composition and successional sequence of some plant communities (especially grassland communities) has changed because of plant and animal species introduced between the late 1700's and early 1900's. These changes related to grazing, agriculture, forestry, and urbanization. The northern part is densely urbanized.

Cultural Ecology. Humans have been utilizing the Section for about 8,000 years, and have been an integral part of central coast ecology for about 2,000 years, thriving on the diversity of habitats from ocean and estuary to forest, and intensively gathering numerous resources. The Spanish established missions throughout the area in the late 1700's and early 1800's, introducing agriculture and religious and social changes. Contemporary attitudes and beliefs are varied, often considered liberal or unconventional, particularly in the San Francisco Bay area. The economy is diverse, ranging from San Francisco Bay area financial and computer industries to rural agricultural and fishing industries; shipping, tourism and recreation are important industries.

Compiled by Pacific Southwest Region.

Section 261B—Southern California Coast

Geomorphology. This Section comprises narrow ranges and broad fault blocks, as well as alluviated lowlands and coastal terraces. It is in the Transverse and Peninsular Ranges geomorphic province. Elevation ranges from sea level to 3,000 ft (0 to 912 m).

Lithology and Stratigraphy. Types include Cenozoic marine and nonmarine sedimentary rocks and alluvial deposits.

Soil Taxa. Soils include Alfisols, Entisols, Inceptisols, Mollisols and Vertisols in combination with thermic and isothermic soil temperature regimes and xeric soil moisture regime.

Potential Natural Vegetation. Kuchler mapped vegetation as chaparral, coastal sagebrush, southern oak forest and valley oak savanna. Predominant potential natural communities are Coastal Sage (Venturan) and Coastal Perennial Grassland series.

Fauna. This Section includes a variety of coastal, marsh, estuary, wetland, riparian, grassland, and oak savanna communities. Mammals include mule deer, coyotes, bobcat, fox, skunk, raccoon, opossum and ground squirrel. Turkey vultures, hawks, jays, quail, owls, herons, egrets, flycatchers, swallows, and ravens are common birds. Birds of concern include the brown pelican, lesser tern, osprey, black rail, clapper rail, California gnatcatcher, and savanna sparrow. Reptiles and amphibians include the western rattlesnake, common garter snake, alligator lizards, and several species of salamanders and frogs. Marine and shore species include sea lions, seals, brown pelicans, gulls, cormorants, terns and various shore birds.

Climate. Precipitation ranges from 10 to 25 in (250 to 640 mm). Temperature averages 61 to 65 °F (16 to 18 °C). Summer daytime temperatures often modified by morning fog and sea breezes. The growing season lasts 250 to 360 days.

Surface Water Characteristics. Very few perennial streams occur in the area. Perennial and intermittent streams occur in alluvial and weak bedrock channels that flow directly to the Pacific Ocean. High velocity

and quantity flows periodically occur in the numerous intermittent drainages.

Disturbance Regimes. Historic occurrence of fire has changed from variable frequency, season, and intensity to more frequent, larger, and more intense fires. This Section is a seismically active area with strong shaking and ground rupture. Some plant and animal species are noticeably affected by air pollution.

Land Use. Composition and successional sequence of some communities (especially grassland communities) has changed because of plant and animal species introduced between the late 1700's and early 1900's. These changes related to grazing, agriculture, and urbanization. Most of the area is densely urbanized.

Cultural Ecology. Humans have been utilizing the area for some 8,000 to 10,000 years. People have been an integral part of south coast ecology for 2,000 to 3,000 years, thriving on the diversity of habitats from ocean and estuary to hills and scrublands, and intensively gathering numerous resources. The Spanish first explored the coastal areas in the mid-1500's; however, they did not establish permanent settlements until the Mission Period, in the late 1700's, thus introducing agriculture and religious and social changes. Widespread urbanization of the Los Angeles basin began in the late 1800's. Contemporary attitudes and beliefs are varied; lifestyle is urban. The international border and large Hispanic populations contribute to cultural diversity. The economy is varied and urban oriented; shipping, fishing, tourism, and recreation are important industries.

Compiled by Pacific Southwest Region.

Province 262—California Dry Steppe

One Section has been delineated in this Province: 262A—Great Valley. The area of this Section, which is located in California, is about 19,200 mi² (49,700 km²).

Section 262A—Great Valley

Geomorphology. This low fluvial plain is in the Great Valley geomorphic province. Elevation ranges from sea level to 800 ft (0 to 243 m).

Lithology and Stratigraphy. This area has Cenozoic nonmarine sedimentary rocks and alluvial deposits.

Soil Taxa. Soils include Alfisols, Entisols, Histisols, Inceptisols, Mollisols, and Vertisols, in combination with a thermic soil temperature regime and xeric, aquic, or aridic soil moisture regimes.

Potential Natural Vegetation. Küchler mapped vegetation as California prairie, riparian forest, tule marsh, San Joaquin saltbush and valley oak savanna. Predominant potential natural communities are Valley Oak, Valley Needlegrass, and Saltbush series.

Fauna. Former inhabitants include grizzly bear, wolf, tule elk, and pronghorn antelope. Much of the natural habitat has been modified throughout the Section. The Section contains wetlands that are important feeding and resting areas for migrating waterfowl. Many waterfowl species are year-round residents. Mammals include mule deer, black-tailed deer, coyote, muskrat, beaver, ground squirrel, cottontail, jack rabbit, kangaroo rat, and the endangered kit fox. Common birds include hawks, golden eagle, owls, white-tailed kite, quail, mourning dove, mockingbird, scrub jay, gulls, herons, crows, western meadowlark, finches, sparrows, roadrunners (southern part), and the introduced Chinese ringneck pheasant.

Climate. Precipitation ranges from 5 to 30 in (130 to 760 mm). Temperature averages 55 to 66 °F (13 to 19 °C). The growing season lasts 230 to 350 days.

Surface Water Characteristics. Many slow moving rivers flow to the delta east of San Francisco Bay via the Sacramento and San Joaquin River systems. Flows to these levied, alluvial channel river systems are regulated

throughout the year by the many dams occurring in adjacent Sections. Constructed deep water ship channels also connect to Sacramento and Stockton. Many rivers and perennial streams flow west from the Sierra Nevada foothills Section to the Sacramento and San Joaquin Rivers. The many alluvial channels that flow eastward from the Coast Ranges to the Sacramento and San Joaquin Rivers are mostly dry during summer months; only a few are perennial streams. The southern part of the San Joaquin Valley drains to basins and does not reach the San Joaquin River.

Disturbance Regimes. Historic occurrence of fire has changed from frequent, fast moving, large fires to infrequent small fires, or fire has been mostly excluded because of conversion to irrigated agriculture and urban uses.

Land Use. Composition and successional sequence of some communities (especially grassland communities) has changed because of plant and animal species introduced between the early 1800's and early 1900's. These changes related to grazing, agriculture, and urbanization. Most of the Section is converted to irrigated agriculture. Rapidly expanding urbanized areas are scattered throughout the Section. Flood control has decreased the duration and extent of wetlands.

Cultural Ecology. Humans have been utilizing the central valley for 10,000 years, and have been an integral part of its ecology for 3,000 to 5,000 years. The valley contains some of the densest year-round prehistoric habitation locations in California, particularly along riparian areas. Intensive occupation, resource procurement and processing practices, and vegetation manipulation through the use of fire sometimes altered the riverine environment. Around the time of the Gold Rush, Euro-americans flooded into the valley, converting the land to agriculture, which became the mainstay of California economy. The river systems provided early transportation routes. Sacramento and Stockton are shipping ports served by deep water channels. Contemporary attitudes and beliefs are varied; lifestyles are both urban and rural; economies are dominated by agriculture, government, and services; populations are diverse.

Compiled by Pacific Southwest Region.

Province 263—California Coastal Steppe, Mixed Forest, and Redwood Forest

One Section has been delineated in this Province: 263A—Northern California Coast. This Section is located along coastal California. The area of this Section is about 4,600 mi² (11,900 km²).

Section 263A—Northern California Coast

Geomorphology. This area has parallel ranges, and folded, faulted, and metamorphosed strata; there are rounded crests of subequal height. This Section is in the Coast Ranges geomorphic province. Elevation ranges from sea level to 3,000 ft (0 to 912 m).

Lithology and Stratigraphy. This area has late Mesozoic eugeosynclinal rocks of the Franciscan Formation, and shelf and slope sedimentary rocks.

Soil Taxa. Types include Alfisols, Inceptisols, Mollisols, Spodosols (Pygmy Forest), and Ultisols, in combination with isomesic and mesic soil temperature regimes, and udic, ustic, and xeric (moist end of range) soil moisture regimes. Fog contributes to soil moisture.

Potential Natural Vegetation. Küchler mapped vegetation as redwood forest, mixed evergreen forest, coastal prairie-scrub, coastal cypress and pine forest, and mixed hardwood forest. Predominant potential natural communities include Redwood, Douglas-Fir, Tanoak, Coast Live Oak, Coastal Sage (Franciscan) and North Coastal Shrub series.

Fauna. Mammals include Roosevelt elk, black-tailed deer, black bear, mountain lion, coyote, bobcat, raccoon, marten, fisher, and river otter. Birds include eagles, hawks, owls, peregrine falcon, osprey, and a variety of shore birds and waterfowl along the coastal part of the section. Species of concern include marbled murrelet and northern spotted owl. Streams and rivers are used by anadromous fish.

Climate. Precipitation ranges from 40 to 100 in (1,020 to 2,540 mm). Temperature averages 50 to 55 °F (10 to

13 °C). Summer daytime temperatures often modified by fog and sea breezes. The growing season lasts 250 to 310 days.

Surface Water Characteristics. Many slow or relatively slow streams and rivers in alluvial and weak bedrock channels flow directly to the Pacific Ocean. Most terminate in tide-affected brackish estuaries.

Disturbance Regimes. Historic occurrence of fire is changing from frequent, low to high intensity surface fires to infrequent, moderate to high intensity stand-replacing fires. This is a seismically active area with strong shaking and ground rupture.

Land Use. Composition and successional sequence of some communities (primarily grassland communities) has changed because of plant and animal species introduced between the early 1800's and early 1900's. These changes related to grazing and forestry. The north part of the Section contains expanding urban areas.

Cultural Ecology. Humans have been utilizing the area for some 8,000 to 10,000 years, and have been an integral part of north coast ecology for some 2,000 to 3,000 years. Early inhabitants thrived on the diversity of habitats from ocean and estuary to forest, and intensively gathered numerous resources. The variety of northwest California ethnographic cultures is the most complex in the United States, reflecting diverse prehistoric and historic uses, practices, and human adaptations. The fur trade was a unique part of northwest coast's early history; later, lumbering and agriculture were the main economic sectors. Contemporary attitudes and beliefs are dichotomized between emphasis on values: amenity for the newcomer and commodity for the long-time resident. However, all are overlain by a rural lifestyle, even in the trendy Marin headlands north of San Francisco. The economy is diverse, ranging from San Francisco Bay area financial and entertainment industries to rural agriculture, forestry, and fishing; tourism and recreation are important industries.

Compiled by Pacific Southwest Region.

Province M261–Sierran Steppe - Mixed Forest - Coniferous Forest

Seven Sections have been delineated in this Province: M261A–Klamath Mountains; M261B–Northern California Coast Ranges; M261C–Northern California Interior Coast Ranges; M261D–Southern Cascades; M261E–Sierra Nevada; M261F–Sierra Nevada Foothills; and M261G–Modoc Plateau. The area of these Sections is about 68,300 mi² (176,900 km²).

Section M261A–Klamath Mountains

Geomorphology. This is an uplifted and dissected peneplain on strong rocks; there are extensive monadnock ranges. Elevation ranges from 1,500 to 8,000 ft (456 to 2,432 m). This Section is in the Klamath Mountains geomorphic province.

Lithology and Stratigraphy. There are Paleozoic sedimentary and volcanic rocks, and Mesozoic ultramafic, granitic, sedimentary, and volcanic rocks.

Soil Taxa. Soils include Alfisols, Entisols, Inceptisols, and Ultisols, in combination with mesic and frigid soil temperature regimes and xeric and udic soil moisture regimes.

Potential Natural Vegetation. Küchler mapped vegetation as Klamath montane forest, mixed evergreen forest, Oregon oak forest and northern yellow pine forest. Predominant potential natural communities are Douglas-Fir, Ponderosa Pine, Mixed Conifer, Jeffrey Pine, White Fir and Red Fir series.

Fauna. Mammals include Roosevelt elk, black-tailed deer, black bear, mountain lion, coyote, bobcat, ringtail, marten, fisher, and river otter. Birds include eagles, hawks, owls, peregrine falcon, osprey, and ruffed grouse. Species of concern include marbled murrelet and northern spotted owl. Streams and rivers are used by anadromous fish.



Typical landscape in the Klamath Mountains Section.

Climate. Precipitation ranges from 40 to 120 in (1,020 to 3,050 mm). Temperature averages 45 to 55 °F (7 to 13 °C). The growing season lasts 60 to 250 days.

Surface Water Characteristics. Many rapid or moderately rapid flowing rivers and streams are in this Section. Most rivers flow westerly in deeply incised canyons with bedrock controlled channels. Some easterly flowing streams in deeply incised canyons flow inland to the Sacramento River. Some water is diverted from the westward flowing Trinity River system eastward to the Sacramento River. There are numerous lakes and meadows associated with glaciated areas above 5,000 feet.

Disturbance Regimes. At lower and mid elevations, historic occurrence of fire has changed from frequent, low intensity ground fires to infrequent, high intensity stand-replacing fires. At higher elevations, historic occurrence has changed from infrequent, low and moderate intensity ground fires to infrequent, low, moderate and high intensity surface or stand-replacing fires. The western part of the Section is seismically active with strong shaking and ground rupture. Wide fluctuations in precipitation and temperature for periods of years result in significant or catastrophic changes in biological communities.

Land Use. Composition and successional sequence of some communities have changed because of plant and animal species introduced between the mid 1800's and early 1900's. These introductions related to mining, grazing, forestry, and recreational activities.

Cultural Ecology. Humans have been utilizing the Klamath Mountains for about 8,000 years, and have been an integral part of the ecology for 2,000 to 3,000 years. The western portion of the Klamath Mountains lies in the northwest California culture area; the diversity of northwest California ethnographic cultures is the most complex in the United States, reflecting diverse prehistoric and historic uses, practices, and human adaptations. Early Euro-American influences and settlement came from mining booms concomitant with the Gold Rush. Contemporary attitudes and beliefs tend to be dominated by commodity oriented long-time resident values and a rural lifestyle. The economy is dominated by government employment, but the timber industry and recreation are also important.

Compiled by Pacific Southwest Region.

Section M261B-Northern California Coast Ranges

Geomorphology. This area has parallel ranges, and folded, faulted, and metamorphosed strata; there are rounded crests of subequal height. Elevation ranges from 1,000 to 7,500 ft (304 to 2,280 m). This Section is in the Coast Ranges geomorphic province.

Lithology and Stratigraphy. There are late Mesozoic eugeosynclinal rocks of the Franciscan Formation, Mesozoic ultramafic rocks, and Cenozoic volcanic rocks.



Red fir forest near Rainbow Park, California.

Soil Taxa. Soils include Alfisols, Entisols, Inceptisols, Mollisols and Ultisols in combination with mesic and thermic soil temperature regimes and xeric soil moisture regime.

Potential Natural Vegetation. Küchler mapped vegetation as Coast Ranges montane forest, mixed evergreen forest, chaparral, blue oak-foothill pine forest, and mixed hardwood forest. Predominant potential natural communities are Douglas-Fir, White Fir, Ponderosa Pine, Tanoak, Interior Live Oak, Coast Live Oak and Mixed Chaparral series.

Fauna. Mammals include black-tailed deer, black bear, mountain lion, coyote, bobcat, and ringtail. Roosevelt elk, marten, and fisher occur in the northern part of the Section. Tule elk and mule deer occur in the southern part. Birds include eagles, hawks, owls, herons, and osprey. Species of concern include marbled murrelet and northern spotted owl in the northern part.

Climate. Precipitation ranges from 30 to 80 in (760 to 2,030 mm). Temperature averages 45 to 59 °F (7 to 15 °C). The growing season lasts 80 to 250 days.

Surface Water Characteristics. There are many rapid or moderately rapid rivers and streams in deeply incised canyons with weak bedrock channels; they flow westerly to the Pacific Ocean.

Disturbance Regimes. Historic occurrence of fire has changed from frequent, low, moderate, and high intensity surface fires to infrequent, high intensity ground or stand-replacing fires. This is a seismically active area with strong shaking and ground rupture. Wide fluctuations in precipitation and temperature for periods of years result in significant or catastrophic changes in biological communities.

Land Use. Composition and successional sequence of some communities have changed because of plant and animal species introduced between the mid 1800's and early 1900's. These introductions related to mining, grazing, forestry, and recreational activities.

Cultural Ecology. Humans have been utilizing the area for about 10,000 years; the Northern California Coast Ranges Section is the type location for the early, Borax Lake, Paleo-Indian component. Humans have been an integral part of Coast Range ecology for 2,000 to 3,000 years. The diversity of northwest California ethnographic cultures is the most complex in the United States, reflecting diverse prehistoric and historic uses, practices, and human adaptations. Contemporary attitudes and beliefs are dichotomized between emphasis on amenity for the newcomer and commodity for the long-time resident. All are overlain by a rural lifestyle. The economy is relatively diverse—government employment, the timber industry, recreation, and agriculture.

Compiled by Pacific Southwest Region.

Section M261C—Northern California Interior Coast Ranges

Geomorphology. This area has parallel ranges and folded, faulted, and metamorphosed strata; there are rounded crests of subequal height. Elevation ranges from 200 to 2,500 ft (61 to 760 m). This Section is in the Coast Ranges geomorphic province.

Lithology and Stratigraphy. There are late Mesozoic shelf and slope sedimentary deposits.

Soil Taxa. Soils include Alfisols, Entisols, Inceptisols, Mollisols and Vertisols in combination with thermic soil temperature regime and xeric soil moisture regime.

Potential Natural Vegetation. Küchler mapped vegetation as blue oak-foothill pine forest, chaparral and California prairie. Predominant potential natural communities are Blue Oak, Mixed Chaparral and Valley Needlegrass series.

Fauna. Mammals include mule deer, black-tailed deer, coyotes, ground squirrels, cottontails, jack rabbits, and kangaroo rats. Birds include turkey vulture, eagles, hawks, owls, quail, mourning dove, mockingbird, scrub jay, western meadowlark, finches, and sparrows.

Climate. Precipitation ranges from 20 to 40 in (510 to 1,020 mm). Temperature averages 55 to 64 °F (13 to 18 °C). The growing season lasts 120 to 270 days.

Surface Water Characteristics. Many rapid perennial or intermittent streams are in deeply incised canyons with weak bedrock channels; they flow easterly to the Sacramento River. Reservoirs for irrigation water and flood control are common.

Disturbance Regimes. Fires are low, moderate, and high intensity surface or stand-replacing fires.

Land Use. Composition and successional sequence of some communities has changed because of plant and animal species introduced between the mid 1800's and early 1900's. These changes related to grazing and agriculture.

Cultural Ecology. Humans have been utilizing the interior Coast Range foothills for 8,000 to 9,000 years, and have been an integral part of the ecology for 3,000 to 5,000 years. Historically, ranching and agriculture provided the primary Euro-American livelihood. Contemporary attitudes and beliefs are dichotomized between emphasis on values: amenity for the newcomer and commodity for the long-time resident. All are overlain by a rural lifestyle. Contemporary economic pursuits include government employment, agriculture, and recreation.

Compiled by Pacific Southwest Region.

Section M261D–Southern Cascades

Geomorphology. These volcanic mountains are variously eroded; there is no distinct range. Elevation ranges from 1,500 to 14,000 ft (456 to 5,256 m). This Section is in the Cascade Range geomorphic province.

Lithology and Stratigraphy. These are Cenozoic volcanic rocks.

Soil Taxa. Soils include Alfisols, Andisols, Inceptisols, and Ultisols, in combination with mesic and frigid soil temperature regimes and xeric and udic soil moisture regimes.

Potential Natural Vegetation. Küchler mapped vegetation as Sierran montane forest, sagebrush steppe, yellow pine-shrub forest and northern yellow pine forest. Predominant potential natural communities are White Fir, Ponderosa Pine, Mixed Conifer, Red Fir, Lodgepole Pine and Oregon Oak series.

Fauna. Mammals include black-tail and mule deer, mountain lion, coyote, bobcat, yellow-bellied marmot, marten, fisher, Sierra Nevada red fox, wolverine, and porcupine. Birds include eagles, hawks, owls, woodpeckers, falcons, osprey, quail, northern goshawk, and blue grouse. Species of concern include the California and northern spotted owl.

Climate. Precipitation ranges from 20 to 80 in (510 to 2,030 mm). Temperature averages 42 to 58 °F (5.5 to 14 °C). The growing season lasts 30 to 200 days.

Surface Water Characteristics. There are many slow and moderately rapid rivers and streams. Rivers flow in alluvial or weak bedrock channels westerly to the Klamath

and Sacramento Rivers, and easterly to basins in the Modoc Plateau Section.

Disturbance Regimes. At lower and mid-elevations, historic occurrence of fire has changed from frequent, low intensity, surface fires to infrequent, high intensity, stand-replacing fires. At higher elevations, historic occurrence has changed from infrequent, low and moderate intensity surface fires to infrequent, low, moderate, and high intensity surface or stand-replacing fires. Wide fluctuations in precipitation and temperature for periods of years result in significant or catastrophic changes in biological communities. This Section contains locations with eruptive activity (lava flows and ash fall) within the past 200 years.

Land Use. Composition and successional sequence of some communities has changed because of plant and animal species introduced between the mid 1800's and early 1900's. These introductions related to mining, grazing, forestry and recreational activities. Expanding foothill communities are scattered throughout the Section.

Cultural Ecology. Humans have been utilizing the Cascades for about 8,000 years, and have been an integral part of its ecology for 2,000 to 3,000 years. The 14,000 ft volcano of Mt. Shasta dominates much of the landscape. It is a traditional cultural property of vital significance to five Native American groups, and of symbolic importance to Euro-Americans as well. The timber industry played an important role historically; railroad logging systems spread throughout timbered areas. Contemporary attitudes and beliefs tend to be dominated by commodity oriented long-time resident values and a rural lifestyle. The economy is dominated by government employment, but the timber industry, recreation, and ranching are also important.

Compiled by Pacific Southwest Region.



Characteristic landscape of the Southern Cascades Section.

Section M261E—Sierra Nevada

Geomorphology. This block mountain range tilts west and has accordant crests. Elevation ranges from 1,000 to 14,495 ft (300 to 4,407 m). Local relief ranges from 500 to 2,000 ft (150 to 600 m). It is in the Sierra Nevada Range geomorphic province.

Lithology and Stratigraphy. There are Mesozoic granitic and ultramafic rocks, Paleozoic and Mesozoic strongly metamorphosed sedimentary and volcanic rocks, and Cenozoic volcanic rocks.

Soil Taxa. Soils include Alfisols, Andisols, Entisols, Inceptisols, Mollisols, and Ultisols, in combination with mesic, frigid, and cryic soil temperature regimes, and xeric, udic, and aquic soil moisture regimes.

Potential Natural Vegetation. Küchler mapped vegetation as Sierran montane forest, upper montane-subalpine forest, alpine communities and barren, and northern Jeffrey pine forest. Predominant potential natural communities are Ponderosa Pine, Ponderosa Pine-Mixed Conifer, Douglas Fir-Mixed Conifer, White Fir-Mixed Conifer, Red Fir, Lodgepole Pine, Jeffrey Pine, Big Sagebrush, Canyon Live Oak, White Alder, Mountain Alder, Huckleberry Oak, Carex and Aspen series.

Fauna. Mammals include black-tail and mule deer, black bear, mountain lion, coyote, bobcat, red and gray fox, ringtail, weasels, skunks, badger, mountain sheep, yellow-bellied marmot, marten, fisher, wolverine, and porcupine. Grizzly bear, native to the western slope, became extinct in 1924. Birds include eagles, hawks, owls, woodpeckers, falcons, osprey, stellar jay, herons, quail, kingfisher, goshawk and blue grouse. Species of concern include the California spotted owl. Introduced species include turkey and beaver.

Climate. Precipitation ranges from 20 to 80 in (500 to 2,030 mm) during fall, winter, and spring. It occurs mostly as snow above 6,000 ft. Rain on snow is common. Summers are dry with low humidity. Temperature averages 42 to 60 °F (5.5 to 15.5 °C). The growing season lasts 20 to 230 days.

Surface Water Characteristics. There are many rapidly flowing rivers and streams. Rivers flow west from the crest in deeply incised canyons with bedrock controlled channels to the Great Valley Section and Pacific Ocean. Rivers flow east from the crest in mostly bedrock controlled channels terminating in basins in the Mojave Desert, Mono or northwestern Basin and Range Sections. Numerous lakes and wet meadows are associated with glaciated areas above 5,000 feet.

Disturbance Regimes. At lower and mid-elevations, historic occurrence of fire has changed from frequent, low intensity ground fires to infrequent, high intensity stand-replacing fires. At higher elevations, historic occurrence has changed from infrequent, low and moderate intensity ground fires to infrequent, low, moderate, and high

intensity surface or stand-replacing fires. Seismically active areas occur along the eastern boundary with strong shaking and ground rupture. Wide fluctuations in precipitation and temperature for periods of years result in significant or catastrophic changes in biological communities. Snow avalanches are common at higher elevations.

Land Use. Composition and successional sequence of some communities have changed because of plant and animal species introduced between the mid 1800's and early 1900's. These introductions related to mining, grazing, forestry, and recreational activities. Expanding urban uses occur, scattered throughout the foothills and some high elevation areas. Water diversions for hydroelectric power, agriculture, and municipal and domestic use are common within and between river systems.

Cultural Ecology. Humans have been utilizing the Sierra for about 10,000 years, and have been an integral part of its ecology for 3,000 to 5,000 years. This is particularly apparent through documented use of fire to facilitate gathering and to generate species preferred for foodstuffs, basketry materials, and other needs. Extensive procurement and processing of lithic, acorn, pine nut, basketry fiber, and other resources resulted in innumerable areas of lithic quarry, bedrock mortar, pinyon, Jeffrey pine, sugar pine, oak grove, and other resource alteration. Contemporary attitudes and beliefs are dichotomized between emphasis on values: amenity for the newcomer and commodity for the long-time resident. Human environment is characterized by a rural lifestyle of open space and outdoor leisure activity. Recreation is the primary economic emphasis, trailed by government employment, lumbering, mining, and grazing. The Sierra is experiencing rapid retiree and commuter resident growth, and large transient recreation populations that provide constant resource pressures.

Compiled by Pacific Southwest Region.

Section M261F—Sierra Nevada Foothills

Geomorphology. This block mountain range tilts west and has accordant crests. Elevation ranges from 500 to 3,500 ft (152 to 1,064 m). It is in the Sierra Nevada Range geomorphic province.

Lithology and Stratigraphy. These are Mesozoic sedimentary, granitic, volcanic and ultramafic rocks.

Soil Taxa. Soils include Alfisols, Entisols, Inceptisols, and Mollisols, in combination with thermic soil temperature regime and xeric soil moisture regime.

Potential Natural Vegetation. Küchler mapped vegetation as blue oak-foothill pine forest, and chaparral. Predominant potential natural communities are Blue Oak, Interior Live Oak, Valley Needlegrass and Mixed Chaparral series.

Fauna. Former inhabitants include grizzly bear and pronghorn antelope. Mammals include black-tailed and mule deer, coyote, ground squirrel, cottontail, jack rabbit, and kangaroo rat. Common birds include turkey vulture, falcons, eagles, hawks, owl, quail, mourning dove, mockingbird, scrub jay, herons, ravens, western meadowlark, fin, and sparrows. Introduced species include turkeys and chukars.

Climate. Precipitation ranges from 20 to 40 in (510 to 1,020 mm). Temperature averages 55 to 64 °F (13 to 18 °C). The growing season lasts 200 to 320 days.

Surface Water Characteristics. There are many rapidly flowing rivers and streams. Rivers flow westerly in deeply incised canyons with bedrock controlled channels to the Great Valley Section and Pacific Ocean. Reservoirs for municipal water supply, irrigation, and flood control are common.

Disturbance Regimes. Fires are low, moderate, and high intensity surface or stand-replacing fires.

Land Use. Composition and successional sequence of some communities have changed because of plant and animal species introduced between the mid 1800's and early 1900's. These introductions related to mining, grazing, and agriculture. Rapidly expanding foothill urban areas are scattered throughout the Section. Large and small water impoundments are common.

Cultural Ecology. Humans have been utilizing the Section for about 10,000 years, and have been an

integral part of its ecology for 3,000 to 5,000 years. Sierran foothills contain some of the densest year-round prehistoric habitation locations in California, particularly along riparian areas, where intensive occupation, resource procurement and processing practices, and vegetation manipulation often altered the environment. Contemporary attitudes tend to be dichotomized between values: amenity for the newcomer and commodity for the long-time resident. Human environment is characterized by a rural lifestyle of open space and outdoor leisure activity. Recreation is the primary economic emphasis, trailed by government employment. The foothills, in particular, are experiencing rapid retiree and commuter resident growth.

Compiled by Pacific Southwest Region.

Section M261G—Modoc Plateau

Geomorphology. This area comprises northwesterly trending fault-block mountains and ridges, with intervening basin-like grabens commonly interspersed with lake bed deposits, shield volcanoes, cinder cones, or lava flows. Elevation ranges from 3,000 to 9,900 ft (912 to 3,010 m). This is in the Modoc Plateau geomorphic province (part of the Basin and Range Province flooded with volcanics related to those of the Cascade Range Province).

Lithology and Stratigraphy. There are Cenozoic volcanic and nonmarine sedimentary rocks and alluvial deposits.



Typical landscape and vegetation of the Modoc Plateau Section.

Soil Taxa. Soils include Alfisols, Andisols, Aridisols, Entisols, Inceptisols, Mollisols, and Vertisols, in combination with mesic and frigid soil temperature regimes and xeric and aridic soil moisture regimes.

Potential Natural Vegetation. Küchler mapped vegetation as yellow pine-shrub forest, juniper-shrub savannah, sierran montane forest, sagebrush steppe, upper montane-alpine forests, and northern Jeffrey pine forest. Predominant potential natural communities are Ponderosa Pine, Mixed Conifer, Western Juniper, White Fir, Big Sagebrush, Low Sagebrush and Carex series.

Fauna. Mammals include mule deer, pronghorn, black bear, mountain lion, coyote, bobcat, yellow-bellied marmot, wolverine, jack rabbit, and porcupine. Birds include eagles, hawks, owls, woodpeckers, falcons, osprey, quail, and sage grouse. The Section contains wetlands that are important resting, feeding, and nesting areas for migrating waterfowl. Species of concern include the California and spotted owl (western part). Species no longer occurring in the Section include mountain sheep and sharp-tailed grouse.

Climate. Precipitation ranges from 12 to 30 in (300 to 760 mm). Temperature averages 45 to 52 °F (7 to 11 °C). The growing season lasts 70 to 140 days.

Surface Water Characteristics. There are few slow flowing rivers and few slow to moderately rapid flowing streams, although most streams do not flow throughout

the summer. Rivers and streams flow in alluvial and bedrock controlled channels to the Sacramento and Klamath Rivers, or to basins within the Modoc Plateau or the northwestern Basin and Range Section. Numerous small to very large lakes and reservoirs occur throughout the Section.

Disturbance Regimes. Historic occurrence of fire has changed from frequent, low intensity ground fires to infrequent, high intensity stand-replacing fires.

Land Use. Composition and successional sequence of some communities have changed because of plant and animal species introduced between the mid 1800's and early 1900's. The introduced species related to grazing, forestry, and agriculture.

Cultural Ecology. Humans have been utilizing the plateau for about 10,000 years, and have been an integral part of its ecology for 3,000 to 5,000 years. Extensive prehistoric procurement and processing of obsidian resources have left vast areas of the plateau pockmarked and littered with lithic debitage. Euro-American influx into the area in the mid-1800's, along the Oregon and California Trails, ushered in agricultural pursuits. Contemporary attitudes and beliefs tend to be dominated by commodity oriented long-time resident values and a rural lifestyle. The economy is dominated by government employment, but ranching and lumbering continue to be important.

Compiled by Pacific Southwest Region.

Province M262—California Coastal Range Open Woodland - Shrub - Coniferous Forest - Meadow

Two Sections have been delineated in this Province: M262A—Central California Coast Ranges; and M262B—Southern California Mountains and Valleys. These Sections are located in California. The area of these Sections is about 24,900 mi² (64,500 km²).

Section M262A—Central California Coast Ranges

Geomorphology. This area has parallel ranges, and folded, faulted, and metamorphosed strata; the rounded crests are of subequal height. This Section is in the Coast Ranges geomorphic province. Elevation ranges from 500 to 3,500 ft (152 to 1,064 m).

Lithology and Stratigraphy. There are Cenozoic marine and nonmarine sedimentary rocks and alluvial deposits; late Mesozoic shelf, slope, and eugeosynclinal sedimentary rocks; and Mesozoic ultramafic rocks.

Soil Taxa. Soils include Alfisols, Aridisols, Entisols, Inceptisols, Mollisols, and Vertisols, in combination with thermic soil temperature regime and xeric and aridic soil moisture regimes.

Potential Natural Vegetation. Küchler mapped vegetation as blue oak-foothill pine forest, California prairie, and chaparral. Predominant potential natural communities are Blue Oak, Interior Live Oak, Valley Oak, Mixed Chaparral, Western Juniper-Pinyon Pine (southern part), Bluegrass, and Valley Needlegrass series.



Characteristic landscape and vegetation of the Central California Coast Ranges Section.

Fauna. Mammals include mule deer, pronghorn, tule elk, coyote, bobcat, ground squirrel, and kangaroo rat. Birds include hawks, eagles, owls, quail, mourning dove, mockingbird, scrub jay, gulls, herons, crows, finches, and sparrows. The California condor is being re-introduced in the southern part of the Section. Introduced species include the Andean condor and feral pigs.

Climate. Precipitation ranges from 10 to 30 in (250 to 760 mm). Temperature averages 55 to 64 °F (13 to 18 °C). The growing season lasts 120 to 270 days.

Surface Water Characteristics. Few slow and moderately slow moving rivers and streams flow northerly to Monterey Bay via the Salinas River. Few streams in alluvial or weak bedrock channels flow directly toward the Pacific Ocean. Many streams that flow eastward in alluvial or weak bedrock channels to the Great Valley Section do not flow throughout the summer. Reservoirs for irrigation and flood control are common.

Disturbance Regimes. Fires are low, moderate, or high intensity ground or stand-replacing fires. This is a seismically active area with strong shaking and ground rupture. Wide fluctuations in precipitation and temperature for periods of years result in significant or catastrophic changes in biological communities.

Land Use. Composition and successional sequence of some communities have changed because of plant and animal species introduced between the mid 1800's and early 1900's. The introductions related to grazing and agriculture.

Cultural Ecology. Humans have been utilizing the Section for about 8,000 years, and have been an integral part of Coast Range ecology for about 2,000 years. World-renown Chumash rock art is a unique reflection of prehistoric lifestyle. Grazing is an important historic use, beginning with land grants during the Mexican period. Contemporary attitudes and beliefs are dichotomized between emphasis on values: amenity for the newcomer and commodity for the long-time resident. All are overlain by a rural lifestyle. Economic emphases are recreation, agriculture, and government.

Compiled by Pacific Southwest Region.

Section M262B—Southern California Mountains and Valleys

Geomorphology. There are narrow ranges and broad fault blocks, alluviated lowlands, and dissected westward sloping granitic uplands. This Section is in both the



Typical landscape and vegetation of the Southern California Mountains and Valleys Section.

Transverse and Peninsular Ranges geomorphic provinces. Elevation ranges from 500 to 11,500 ft (153 to 3,496 m).

Lithology and Stratigraphy. There are Cenozoic marine and nonmarine sedimentary rocks and alluvial deposits, and Mesozoic granitic rocks.

Soil Taxa. Soils include Alfisols, Entisols, Inceptisols, and Mollisols, in combination with thermic, mesic, and frigid soil temperature regimes and xeric and aridic soil moisture regimes.

Potential Natural Vegetation. Küchler mapped vegetation as southern oak forest, coastal sagebrush, chaparral and southern yellow pine forest. Predominant potential natural communities include Chamise, Ceanothus, Mixed Chaparral, Scruboak, Coast Live Oak, Englemann Oak, Needlegrass, Jeffrey Pine, Canyon Oak and Big Cone Douglas-Fir series.

Fauna. Mammals include mule deer, pronghorn, bighorn sheep, coyote, bobcat, mountain lion, ground squirrel, and kangaroo rat. Birds include hawks, eagles, owls, quail, mourning dove, mockingbird, jays, gulls, herons, crows, finches, and sparrows. Species of concern include cactus wren, California gnatcatcher, Bell's vireo, foothill and mountain yellow-legged frog, orange-throated whiptail, and California mountain kingsnake.

Climate. Precipitation ranges from 10 to 40 in (250 to 1,020 mm). Temperature averages 45 to 64 °F (7 to 18 °C). The growing season lasts 100 to 200 days.

Surface Water Characteristics. Rivers and streams are common, but most do not flow throughout the year. Rivers and streams flow in alluvial and weak bedrock channels westward to the Pacific Ocean, or eastward to

basins in the Mojave Desert or Sonoran Colorado Desert Sections. Many reservoirs for municipal water supply and flood control occur below steep mountains throughout the Section.

Disturbance Regimes. There are stand-replacing fires of variable frequency, season, and intensity. This is a seismically active area with strong shaking and ground rupture. Some plant and animal species show effects of air pollution. Movement of coarse soil particles by gravity (dry ravel) is a common process in steep mountainous portions of the area.

Land Use. Composition and successional sequence of some communities have changed because of plant and animal species introduced between the mid 1800's and early 1900's. These introductions related to urbanization, grazing, agriculture, and recreational activities. Valley portions are densely populated.

Cultural Ecology. Humans have been utilizing the area for some 10,000 years; the early San Dieguito Paleo-Indian hunting assemblage is well documented at sites along the San Dieguito River. After the end of the Pleistocene, prehistoric assemblages reflect extensive practice of seasonal rounds for resource gathering. Late in the 1700's the Spanish established colonies and missions, and converted the economy of the entire area to ranching and farming; the later citrus industry became a major agricultural influence. Contemporary attitudes and beliefs are varied; lifestyle is urban. The international border and large Hispanic populations contribute to cultural diversity. The economy is varied and urban oriented; tourism and recreation are important industries.

Compiled by Pacific Southwest Region.

Province 311—Great Plains Steppe and Shrub

One Section has been delineated in this Province: 311A—Redbed Plains, most of which is located in Oklahoma. The area of this Section is about 17,600 mi² (45,600 km²).

Section 311A—Redbed Plains

Geomorphology. This Section is in the Central Lowlands geomorphic province. Platform uplift of continental sediments deposited previously into a shallow inland sea, followed by a long period of erosion; these processes resulted in a moderately to strongly dissected region. About 70 percent of this Section consists of irregular plains. Other landforms include about equal areas of plains with low mountains, smooth plains, and tablelands. Elevation ranges from 1,600 to 3,000 ft (500 to 900 m). Local relief in much of the Section ranges from 100 to 300 ft (30 to 90 m). Smaller areas are present where relief ranges from 30 to 60 ft (10 to 20 m) in tablelands and up to 1,000 ft (300 m) in low mountains.

Lithology and Stratigraphy. Rocks formed during the Paleozoic Era. About 80 percent of the geologic strata consist of Permian marine deposits (sandstone, shale, and limestone). Other strata include Quaternary marine deposits and small isolated areas of Lower Cretaceous marine deposits (limestone).

Soil Taxa. Soils are Ustolls, Ustalfs, and Ochrepts. Most soils are on uplands and include Argiustolls, Paleustolls, Natrustolls, Haplustalfs, Paleustalfs, and Ustochrepts. Localized areas of Ustifluvents are on flood plains. These soils have a thermic temperature regime, a ustic moisture regime, and mixed mineralogy. Most soils are deep, well drained, variable in texture, and have limited moisture supplies for use by vegetation during part of the growing season.

Potential Natural Vegetation. Küchler classified vegetation as bluestem-grama prairie, and cross timbers (*Quercus-Andropogon*); shinnery (*Quercus-Andropogon*); and sandsage-bluestem prairie. The predominant

vegetation form is medium-tall grasslands with sparse tree cover. Grasses consist mainly of sand bluestem, little bluestem, and sand saltbrush.

Fauna. Representative large to medium size herbivores and carnivores include coyote, ringtail, and ocelot. Small herbivores include eastern cottontail, desert shrew, plains pocket mouse, Texas kangaroo rat, and prairie vole. Bison and black-footed ferret are historically associated with this Section. Common birds of thickets and grasslands include the roadrunner, bobwhite, barn owl, scissor-tailed flycatcher, and common crow. The golden-fronted woodpecker has a more restricted range. Amphibians common to this environment include Plains spadefoot toad, Great Plains narrow-mouthed frog, green toad, spotted chorus frog, and yellow-mud turtle. Typical reptiles include lesser earless lizard, Texas horned lizard, Prairie skink, and Texas blind snake.

Climate. Precipitation averages 20 to 30 in (500 to 750 mm); snow averages 20 to 30 in (500 to 750 mm) annually. Temperature averages 57 to 64 °F (14 to 18 °C). The growing season lasts 185 to 230 days.

Surface Water Characteristics. The area has a low density of small to medium intermittent streams and associated rivers, most with a low volume of water flowing at low velocity. Dendritic drainage pattern has developed without bedrock structural control. Major rivers include the Washita, Canadian, and Red.

Disturbance Regimes. Fire and drought have probably been the principal historical disturbances.

Land Use. Natural vegetation has been converted to agricultural crops or pasture on about 90 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Province 313—Colorado Plateau Semi-Desert

Five Sections have been delineated in this Province: 313A—Grand Canyon; 313B—Navajo Canyonlands; 313C—Tonto Transition; 313D—Painted Desert; and 313E—Central Rio Grande Intermontane. These Sections are located in the southwestern conterminous States, including parts of Arizona, New Mexico, Utah, and Colorado. The area of these Sections is about 75,300 mi² (195,000 km²).

Section 313A—Grand Canyon

Geomorphology. This Section is in the Colorado Plateau physiographic province. Grand Canyon lands are in the south-central part of Utah and the northern portion of Arizona. It extends into the southwestern corner of Colorado. This area is eroded by the Colorado River and its tributaries. Deep sheer-walled canyons, lines of cliffs, elevated plains, low plateaus, mesas, buttes, and badlands dominate landscape. Major landforms are the Grand Canyon and Colorado Plateau. Elevation ranges from 4,200 to 7,800 ft (1,300 to 2,400 m).

Lithology and Stratigraphy. There are Cretaceous, Jurassic, and Triassic aged sedimentary rock with some Permian aged sediments in northern Arizona. Eolian deposits occur on the east side of the Section. Zion National Park occurs in this Section. All sedimentary rocks are dominantly shales and sandstone, with some limestone.

Soil Taxa. Soils include Torriorthents, Torrifluvents, Ustochrepts, and Haplustalfs in combination with mesic and frigid soil temperature regimes, and ustic soil moisture regimes. A few Haplargids occur with thermic soil temperature regime and aridic soil moisture regime. Some soils are saline-sodic affected. Areas of very sandy soils exist.

Potential Natural Vegetation. This area consists of pinyon-juniper woodland with a small area of Great Basin sagebrush, and blackbrush vegetation. The area has a cold desert shrub and steppe woodland vegetation, with some paleoendemic blackbrush.



Grand Canyon Section.

Fauna. Reserved.

Climate. Precipitation ranges from 3 to 18 in (80 to 458 mm) annually, with more than half of the annual precipitation falling during the winter. Summers are dry with low humidity. Temperature averages 47 to 55 °F (8 to 23 °C). The growing season lasts 110 to 180 days.

Surface Water Characteristics. Water is scarce. The area is drained by the Colorado River and its tributaries. Ground water supplies are deep and limited. Summer rain storms cause flash flooding in much of the Section. Few lakes and reservoirs occur, with Lake Powell being the largest.

Disturbance Regimes. Fire is cyclical. Grazing for sheep and cattle is the major land use. Hay and pasture lands also occur to a very limited extent along drainage ways. Climate is very dry and hot in the summer and cold and moist in the winter, indicative of a cold, desertic condition.

Land Use. Reserved.

Cultural Ecology. The earliest human occupation of the Grand Canyon Section likely occurred between 11,000 and 13,000 years ago and was characterized by an emphasis on big game hunting, supplemented by the gathering of wild plant foods. Evidence for these activities is sparse and is restricted to the discovery of Paleo-Indian projectile points. Between 8,000 and 10,000 years ago, there appears to have been an increase in summer and annual temperatures, and a shift from the winter dominant to a summer dominant or split precipitation regime. These changes led to alterations in subsistence patterns over the next 6,000 years, evolving to a culture in which highly mobile hunter and gatherer groups exploited a wide range of resources in many environmental zones, likely in a structured seasonal round. The upper elevations seem to have been particularly favored during this period, especially during the hot summer months. The use of horticulture as a primary subsistence strategy began in the area about 2,000 years ago, but was not adopted uniformly across the region until about 1,000 to 1,200 years ago. In general, however, human populations began to slowly grow and become increasingly sedentary. The proximity to arable land appears to have been a primary determinant for habitation site locations during this period, continuing to the end of the prehistoric sequence about 1600 A.D. During most of this period, habitation sites tended to be concentrated on low ridges, terraces, and knolls overlooking adjacent alluvium. Numic-speaking hunter and gatherer groups entered the western portion of the area from the Great Basin by about 1200 A.D. Hunting and gathering Athabaskan speaking peoples arrived in the northeast and eastern portions of the area by about 1500 A.D. Both groups exploited many of the same wild resources as the sedentary horticulturists.

The earliest historical records for the Grand Canyon lands suggest that few Anglos were present in the area before about 1776, although members of Coronado's expedition reportedly viewed the Grand Canyon in the early 1540's. The Spanish presence was transitory and consisted of expeditions searching for routes to and from California. The area was settled by Anglos beginning in the 1850's, through the colonization efforts of the Mormon Church. During the late 19th century, ranching, homesteading, and some lumbering were primary activities throughout the area. By the turn of the century, tourism and recreation had begun to play an important role, particularly near the Grand Canyon and southern Utah. At the present time, the area continues to be characterized by small rural communities, often separated by fairly great distances. Lumbering, ranching, fuel wood gathering, hunting, recreation and related tourism, provide the primary subsistence base. The establishment of the National Park system after 1916 has been a major influence on the area's economy.

Compiled by Southwestern Region.

Section 313B-Navajo Canyonlands

Geomorphology. This Section is in the Colorado Plateaus physiographic province. Navajo Canyonlands are in the northeast part of Arizona and southeast Utah. Geomorphic processes active in this area are deep canyon formations as the result of plateau dissection. Volcanic mountains exist in this Section, but block-fault structural mountain ranges do not. Major landforms are canyonlands, plateaus, plains, and hills. Major landform features are the Painted Desert, Vermillion and Echo Cliffs, Glen Canyon Recreation Area, and Canyonlands National Park. Elevation ranges from 4,000 to 8,000 ft (1,210 to 2,425 m).

Lithology and Stratigraphy. There are Cretaceous, Jurassic, and Triassic aged sedimentary rocks with some Quaternary and upper Tertiary sedimentary deposits and valley fills.

Soil Taxa. Soils include Haplustals, Calciorthis, Haplargids, and Ustochrepts, and a few Haplustolls, Calcistolls, and Argistolls in combination with mesic soil temperature regimes, and ustic and aridic soil moisture regimes.

Potential Natural Vegetation. Vegetation consists of pinyon-juniper woodlands at higher elevations. Grama and galleta grasses are found at lower elevations; greasewood and saltbrush are found on calcareous and salt affected soils.



Pronghorns are typical fauna in the Navajo Canyonlands Section.

Fauna. Species include pronghorn antelope, jackrabbits, desert mouse, and rattlesnakes.

Climate. Precipitation ranges from 8 to 18 in (200 to 458 mm) annually, with more than half of the precipitation falling during the winter. Temperature averages 45 to 57 °F (7 to 13 °C) and winters are cold. The growing season lasts 110 to 180 days.

Surface Water Characteristics. Water is scarce. The Little Colorado River drains most of the area, but its flow is intermittent; water is commonly stored in small reservoirs.

Disturbance Regimes. Fires are variable in frequency and intensity. Flash floods and drought are common. Approximately 90 percent of this area is rangeland. It is grazed by both cattle and sheep.

Land Use. Reserved.

Cultural Ecology. Although Paleo-Indian and Archaic hunting and gathering people utilized this Section for thousands of years, it was the Anasazi farmers who left the most striking marks upon the land. Their settlements were located near water in or adjacent to pinyon-juniper woodlands, which offered abundant plant and animal resources used to supplement their crops. Most areas were somewhat marginal for agriculture, and communities continued to utilize nearby mountains and lower elevation areas for hunting and gathering activities. Eventually the Anasazi constructed impressive towns such as those in Chaco Canyon, Mesa Verde, and Tsegi Canyon. Paleontological studies indicate that the short duration of many sites may have been related to the need to relocate due to depletion of wood resources needed for fuel

and building materials. Local population pressure and a long period of drought are considered factors in the abandonment of most of this unit by the early 1300's and the subsequent aggregation of pueblo populations at Hopi, Zuni, and along the Rio Grande.

At the time of Spanish contact, the area was largely uninhabited except for the Hopi villages. Early Navajo and Apache and Ute peoples used the area for hunting, gathering, and some horticulture. Spanish use of the area was limited, and it was not until the mid 1800's that the American government led campaigns against the Navajo people and opened the area for settlement. Eventually, much of this Section was included in the Hopi and Navajo Reservations. Overgrazing by sheep and a natural period of downcutting around the turn of the century contributed to the erosional characteristics visible today. Coal, oil, and gas resources in the northern portions of the Section have been exploited in boom-and-bust cycles. Today the area is largely rural, with a few sizable towns. Grazing, agriculture, mineral development, and tourism contribute to the economy. The Four Corners area offers unsurpassed scenic and heritage values.

Compiled by Southwestern Region.

Section 313C-Tonto Transition

Geomorphology. The Tonto Transition Section lies between the Basin and Range and Colorado Plateaus physiographic provinces. The Tonto Transition Section is located in central and northwest central Arizona. Precambrian through Mesozoic volcanic activity and sedimentary deposition were major geomorphic processes. Lava flows, plugs, dikes, and relatively flat sedimentary deposits resulted. Major landforms are mountains, hills, scarps, and some plains. Major landform features include the Mazatzal Mountains, Black Hills, Aquarius Mountains, Bradshaw Mountains, and the Superstition Mountains. Elevation ranges from 3,000 to 7,400 ft (915 to 2,255 m).

Lithology and Stratigraphy. There are Precambrian metavolcanics, and metamorphic and sedimentary rocks with Tertiary and Quaternary volcanic and sedimentary rocks.

Soil Taxa. Soils include Ustochrepts, Ustifluvents, Ustorthents, Haplustalfs, Argiustolls, Argiborolls, and Eutroboralfs, and a few mesic and frigid soil temperature regimes and ustic soil moisture regimes.

Potential Natural Vegetation. Vegetation consists of interior chaparral of *Turbinella* oak on coarse igneous parent materials, steep slopes, and fire disturbed regimes. There are pinyon-juniper on elevations higher than about 4,200 ft (1,280 m); ponderosa pine occurs in frigid and limited mesic soil temperature regimes at higher elevations.



Chaparral community in Prescott National Forest.

Fauna. Reserved.

Climate. Precipitation ranges from 10 to 25 in (250 to 635 mm) annually, with more than half of the precipitation falling during the winter. Temperature ranges from 40 to 70 °F (4 to 20 °C); winters are mild below about 6,800 ft (2,075 m) and cold at higher elevations. The growing season lasts 70 to 170 days.

Surface Water Characteristics. Much of the area is drained by the Verde River into the Salt River. This area supplies much of the water to adjoining irrigated areas. Because more than half of the precipitation falls during the winter, it is commonly stored in reservoirs for livestock and domestic use; there usually is a deficiency of water in the summer. Ground water is limited and usually occurs at great depth.

Disturbance Regimes. Fire climaxes occur on steep slopes and many coarse igneous rocks in mesic and thermic soil temperature regime areas in the interior chaparral community. Frequency is variable, but may range from 25 to 100 years. Flash floods and droughts are common. Land use includes cattle grazing, irrigated crop land, recreation, and harvest of small areas of commercial timber.

Land Use. Reserved.

Cultural Ecology. Humans have utilized this area for the last 11,000 years. Prior to the end of the Pleistocene, small groups practiced diversified hunting and gathering following seasonal rounds. About 2,000 years ago, most of these groups began to practice corn agriculture, initiating a long-term trend toward increasing sedentism and population growth. Prior to about 1100 A.D., sedentary homesteads and villages were more or less confined to those river valleys suitable for irrigation or flood plain farming. Afterwards, with the widespread adoption of rainfall harvesting technologies, temporary, seasonal, and permanent settlements spread into all geographic areas. In many places this resulted in extensive landscape modification for agriculture, including the displacement of native plant species and the initiation of local erosion cycles. By 1300 A.D., the prehistoric population in the Section had again become concentrated in the irrigable valleys, and large portions of the uplands were abandoned. By 1400 A.D., the entire area was essentially abandoned following a succession of debilitating droughts and floods.

Several hundred years later, new groups of hunter-gatherers re-occupied it at much lower population levels. The first Europeans in the area entered it only briefly in the 16th century. They were followed by trappers and prospectors in the middle 19th century. Shortly thereafter, the military established a presence and removed much of the native population onto reservations. The army was

quickly followed by miners and cattle ranchers. Several consecutive mining booms for gold, silver, and copper were responsible for most of the urbanization seen in the Section as well as extensive landscape modification for exploration and extraction. Further extensive modifications occurred following the turn of the century, when a large portion of the central part of the area was developed for reservoir-based reclamation projects. By that time, the sparsely populated area had developed a mixed economy based on rural agriculture and cattle ranching, mining, and forest products. In recent decades, this economy has been supplemented by recreation, tourism, and retirement developments to support a rapidly growing population. Contemporary attitudes and beliefs are highly varied, ranging from traditional Native American to those held by residents dependent on modern urban development and amenities. The human environment is primarily characterized by a mixture of urban and rural lifestyles. Large expanses of open and unoccupied space are heavily used for outdoor leisure activities, most of which originate from the Phoenix area, located just outside of the Section. The Tonto Transition Section encompasses portions of the San Carlos Apache,

Fort Apache, and Havasupai Reservations. The modern economy is primarily focused on recreation and tourism and mining, with secondary emphases on commerce and light manufacturing, grazing, forest products, and government employment.

Compiled by Southwestern Region.

Section 313D—Painted Desert

Geomorphology. This Section is in the Colorado Plateaus physiographic province. Geomorphic processes active in this area are Mesozoic sedimentary deposition followed by tilting and erosion into majestic plateaus. Major landforms are plains, hills, canyonlands, and valley plains. Elevation ranges from 4,000 to 7,000 ft (1,210 to 2,134 m).

Lithology and Stratigraphy. There are Jurassic and Triassic sedimentary rocks and a few areas of Paleozoic and Precambrian sedimentary rocks.



Painted Desert Section in northwestern Arizona.

Soil Taxa. Soils include Haplustalfs, Ustochrepts, and some Haplustolls, Calciustolls, and Argiustolls with a mesic soil temperature and ustic soil moisture regime. A few soils are in areas with a mesic soil temperature regime and a few Torriorthents and Calciorthids are in aridic soil moisture regime.

Potential Natural Vegetation. Grama and galleta grasses occur at lower elevations and pinyon-juniper woodlands at higher elevations; saltbrush-greasewood type occur in dry, salt affected, and calcareous soils.

Fauna. Reserved.

Climate. Precipitation ranges from 8 to 20 in (200 to 508 mm) annually, with about 45 percent of the precipitation falling during the winter. Temperature averages 45 to 57 °F (7 to 14 °C) and winters are generally cold. The growing season lasts 100 to 170 days.

Surface Water Characteristics. Water is scarce. The Little Colorado River and Zuni River drain most of the area, but their flows are intermittent. Water is commonly stored in reservoirs.

Disturbance Regimes. Fires are variable in frequency and intensity. Flash floods and drought are common. Most of this area is rangeland. It is grazed by both sheep and cattle.

Land Use. Reserved.

Cultural Ecology. The Painted Desert Section has been home to a variety of different human groups over the centuries. Clovis projectile point fragments have been found in the Little Colorado River Valley itself, as well as near the Flagstaff area, on the west end of the Section. Later hunter-gathering people roamed throughout the area, and developed small, scattered pit house settlements during late Archaic and Basketmaker II times along ridges and hilltops. The open grassy plains in the eastern end of the unit were particularly important Archaic centers of occupation. In fact, one localized Archaic tradition has been named for this area - the Concho Complex. In the northern side of the Section, the environment is composed mostly of sand dunes and outcrops of Moenkopi sandstone that are covered by low scrub. Human use was limited to areas where springs or washes could sustain a seasonal water supply. In the more hospitable areas, a substantial presence of Basketmaker III pit-house villages developed, especially along the first terrace of the Little Colorado River. In the eastern end of the Section, these populations showed more similarities with the Mogollon culture. These populations remained fairly intact until about 900 A.D., after which time there were some major population re-adjustments and a dispersion to new areas. A pattern of aggregation is evident by 1250 to 1300, culminating by 1400 with the concentration of population into approximately 35 large pueblos. Between 1300 to 1500, this unit was one of the major population centers of the Southwest; but it, too, was mostly abandoned by 1500 as people moved

to the Hopi Mesa country to the north, and the Zuni country to the east. Historic Hopi and Zuni traditions allude to problems with insects, disease, and internal stress within the population as factors causing these abandonments.

During historic times, the aridity of the Little Colorado River desert and steep canyons of Canyon Diablo posed major obstacles to people wishing to cross the area. Many stories and diaries that recount the difficulties people had when trying to make such a crossing. Nonetheless, in 1863 a party from Santa Fe made camp at what is now the highway stop of Navajo to officially take charge of the Arizona Territory. Mormon colonists from the White Mountains to the south, aided by others from Salt Lake City, began to settle and farm the area, establishing numerous small towns both in the southeastern side of the Section and at scattered places along the Little Colorado River, such as Winslow, Holbrook, Woodruff, and Joseph City. During the historic period, due to climate change and cattle overgrazing from the extensive Hash Knife cattle outfit, the river valley became dry and alkaline. The main life-line of habitation became first the railroad, and later Route 66 and Interstate 40. The Hopi people consider the entire unit to be within their ancestral territory. To a lesser degree, this also holds for the Zuni, although their ties are strongest with the eastern part of the Section. The south edge of the unit was Apache country, while the Navajo made sporadic use of the north and western sides.

Compiled by Southwestern Region.

Section 313E—Central Rio Grande Intermontane

Geomorphology. This Section, which is in the Basin and Range physiographic province, is located in central New Mexico. Active geomorphic processes in this Section are basins produced by erosional and depositional action of running water. Major landforms are valleys and lowland and outwash plains, and alluvial fans and terraces. The Rio Grande basin is the major landform feature.

Lithology and Stratigraphy. There are Cenozoic, Pleistocene and Miocene sedimentary rocks and alluvial deposits, with a few late Tertiary-Quaternary volcanic rocks.

Soil Taxa. Soils include Hapustalfs, Ustochrepts, Haplustolls, Ustifluvents, Torriorthents, and Fluvaquents with mesic soil temperature regime and ustic soil moisture regimes and aquic conditions.

Potential Natural Vegetation. Grama and galleta grasses and four-wing saltbrush occur along with sand sage at lower elevations; pinyon-juniper woodlands are at higher elevations. A few areas have riparian species such as cottonwood and willow.

Fauna. Reserved.

Climate. Precipitation ranges from 8 to 16 in (204 to 400 mm) annually, with less than half of the precipitation falling during the winter. Temperature averages 40 to 57 °F (4 to 14 °C). The growing season lasts 130 to 180 days.

Surface Water Characteristics. Water is scarce throughout this Section.

Disturbance Regimes. Fires are variable in frequency and intensity, depending on fuel and moisture. Most of this Section is grazed by sheep and cattle.

Land Use. Reserved.

Cultural Ecology. For the past 12,000 years, the basin that makes up most of this Section has offered human groups the resources of a flowing river and broad flood plain, plus a milder climate and more protected environment than adjacent plateaus and plains. Traces of Paleo-Indian hunting camps and abundant remains of Archaic campsites are found along the gravel hills and mesas that border the Rio Grande and Rio Puerco. Starting some 1500 years ago, more permanent settlements began to appear as human groups made the transition to greater reliance on agriculture. It was not until around 1300 A.D., however, that large populations began to aggregate along the Rio Grande, a development coinciding

with the abandonment of much of the Colorado Plateau. Early Spanish accounts document many multi-storied pueblos along the Rio Grande, stretching from what is now Socorro north to Bernalillo and beyond. Accounts describe many fields along the river with occasional groves of cottonwood. The Rio Grande pueblos were decimated in the 16th and 17th centuries, however, due to disease, Spanish oppression, and the attacks of other newcomers to the area, the Apache. Today only six pueblos survive in this Section.

Although traders on the Camino Real regularly moved goods between Santa Fe and Chihuahua, Spanish settlement before 1800 was concentrated in the northern part of the basin due to the dangers of Apache raids. The Mexican Period and finally the American takeover opened up the region to trade and settlement. This was vastly accelerated by the arrival of the railroads in the late 1800's. Even today, however, population is concentrated in towns along the Rio Grande, which continues to serve as a transportation and communication corridor. The area is characterized by a mix of old Hispanic communities, urban populations, pueblos, and tourists. Commerce, light industry, tourism, and, to a lesser extent, agriculture and ranching, contribute to the economy. Contemporary issues include growth, water, and conflicting cultural values.

Compiled by Southwestern Region.

Province 315—Southwest Plateau and Plains Dry Steppe and Shrub

Six Sections have been delineated in this Province: 315A—Pecos Valley; 315B—Texas High Plains; 315C—Rolling Plains; 315D—Edwards Plateau; 315E—Rio Grande Plain; and 315F—Southern Gulf Prairies and Marshes. These Sections are located in the New Mexico and Texas. The area of these Sections is about 160,900 mi² (416,700 km²).

Section 315A—Pecos Valley

Geomorphology. This section is in the Great Plains physiographic province. It is located in west-central New Mexico. Major landforms are plains, hills, basins, and fans. Major landform features include the Pecos Plains and the Canadian Valley. Elevation range from 4,000 to 6,900 ft (1,200 to 2,100 m)

Lithology and Stratigraphy. There are Paleozoic, Mesozoic, and Cenozoic aged sedimentary and volcanic rocks and alluvial deposits.

Soil Taxa. Soils include Haplustalfs, Ustochrepts, Argiustolls, Haplustolls, and a few Haplargids, Calciothids, and Ustorthents.

Potential Natural Vegetation. Vegetation consists of grama and galleta grass, pinyon-juniper in mesic soil temperature regimes, and ustic soil moisture regimes, and mesquite bush in aridic soil moisture regimes.

Fauna. Reserved.

Climate. Precipitation ranges from 8 to 16 in (200 to 400 mm) annually, with less than half of the precipitation falling in the winter. Temperature ranges from 45 to 70 °F (7 to 21 °C) and winters are cold. The growing season last 160 to 200 days.

Surface Water Characteristics. Water is scarce throughout this Section because of low annual accumulation and erratic precipitation. Only a few perennial streams exist. Ground water in deep sand and gravel deposits or where limestone residuum exists provides for domestic and livestock use.

Disturbance Regimes. Fires vary in frequency and intensity, depending on fuel load and moisture.

Land Use. The land in most of this Section is in farms, ranches, or private holdings. More than 75 percent of the area is managed as rangeland with cattle and sheep grazing.

Cultural Ecology. Although there are periods of population expansion and periods of decline, sometimes approaching near abandonment, humans have occupied

the Great Plains physiographic province, which partially includes the Pecos Valley Section, for at least 12,000 years. There is inconclusive evidence of substantial earlier occupation. A dependency on hunting of large herbivores which, in turn, were dependent on the vast grasslands of this Province, characterized man-ecosystem relationships for the first 11,000 years of this 12,000 year period. The earliest well-dated sites are those of mobile peoples who, early in this period, hunted mammoth but later hunted a now extinct species of bison. In time the big game hunters were followed by peoples with a more diversified subsistence based on hunting a variety of animals, but, who, no doubt, were heavily dependent on hunting modern bison and gathering a variety of plant resources. The adoption of farming about 1,000 years ago, in combination with hunting and wild plant gathering, eventually led to the appearance of settled villages located sporadically along perennial water courses.

About the beginning of the historic period, the settled village life of plains agriculturalists was supplanted by a re-appearance of groups more heavily dependent on hunting, supplemented with some farming. These relatively mobile groups included Apache and Comanche, with a later appearance of Kiowa. One practice which allowed mobile, hunting plains peoples to exist with diminished emphasis on farming was considerable trade. In the late 1700's and early 1800's, trade began with Puebloan peoples to the west in the foothills of the Sangre de Cristo Mountains. Historic trails, including the Santa Fe Trail, passed through the Pecos Valley Section. These trails were important in the movement west of Anglo settlers and in the movement of cattle and other commodities. The advent of transcontinental railroads in the late 1800's contributed greatly to slaughter of the buffalo, after which time hunting was never again an important subsistence pursuit in the area. Military subjugation of Native American peoples, in combination with the railroads, led to relatively rapid settlement of the western plains by Anglos, who established a rural lifestyle based largely on farming and ranching, which persists to the present.

Compiled by Southwestern Region.

Section 315B—Texas High Plains

Geomorphology. This Section is in the Great Plains geomorphic province. The predominant landform consists of a broad, extensive flat plain formed by fluvial sedimentation of continental erosional products from adjacent mountain ranges, followed by sheet erosion and transport. These processes resulted in a region of moderate dissection. Elevation ranges from 2,600 to 6,500 ft (800 to 2,000 m). Local relief in most of the Section

ranges from 100 to 300 ft, however, relief in the tablelands ranges from 300 to 500 ft.

Lithology and Stratigraphy. Rocks were formed during the Paleozoic (10 percent), Mesozoic (10 percent), and Cenozoic (80 percent) Eras. Paleozoic strata consist of Permian marine deposits (sandstone, shale, and limestone). Mesozoic strata consist of Triassic continental deposits (sandstone). Cenozoic strata consist of Tertiary Period deposits (poorly consolidated silt, sand, and gravel in varying proportions).

Soil Taxa. Soils are Ustolls and Ustalfs. Paleustolls, Argiustolls, Paleustalfs, and Haplustalfs are on uplands. Calciustolls, Haplustolls, and Paleustolls are on ridges and steeper slopes. Haplustolls occur on young valley floors. Pellusterts are in clayey playa-lake basins. Calciorthids, Paleorthids, and Torriorthents are on steep slopes in breaks. These soils have a mesic or thermic temperature regime, a ustic moisture regime, and mixed or carbonatic mineralogy. Soils are deep, fine to coarse textured, well drained, and have limited soil moisture for use by vegetation during parts of the growing season.

Potential Natural Vegetation. Küchler classified vegetation as grama-buffalo grass and shinnery (*Quercus-Andropogon*). The predominant vegetation form is short grass communities composed of bunch grasses with a sparse shrub layer. Species include short grasses (blue gramma, and buffalograss), sagebrush, mesquite, and yucca.

Fauna. Typical large to medium size herbivores and carnivores include pronghorn, coyote, swift fox, ringtail,

and ocelot. Typical smaller herbivores include desert shrew, desert cottontail, black-tailed prairie dog, yellow-faced pocket gopher, plains pocket mouse, silky pocket mouse, hispid pocket mouse, and white-throated woodrat. Bison are historically associated with this Section. Birds of grasslands include many species that typically occur over a wide area, such as roadrunner, house finch, yellow warbler, willow flycatcher, cedar waxwing, western kingbird, and golden eagle. The lesser prairie chicken, found here, is restricted to the more arid grasslands. Amphibians found in this Section include plains spadefoot toad, Couche's spadefoot toad, western spadefoot toad, plains leopard frog, Great Plains toad, green toad, red spotted toad, spotted chorus frog, and yellow-mud turtle. Reptiles include species such as Texas horned lizard, round-tailed horned lizard, Great Plains skink, Texas blind snake, and plains black-headed snake.

Climate. Precipitation averages 15 to 22 in (370 to 550 mm), occurring mainly in the spring and fall. Temperature averages 55 to 63 °F (13 to 17 °C). The growing season lasts 130 to 220 days.

Surface Water Characteristics. There is a low density of small intermittent streams and few associated rivers, all with low volume of water flowing at low velocity. A shallow dendritic drainage pattern has developed. Major rivers include the Canadian and Red. The Canadian River, in north Texas, is deeply incised into the Great Plains plateau and has developed a broad area (up to 50 mi wide) of complex topography locally known as "The Breaks." Playa lakes are common in the western part of this Section.



The predominant landform of the Texas High Plains Section is a flat plain having dry soils. Precipitation is sufficient to support only a sparse herbaceous layer of short bunch grasses and scattered low, thorny shrubs.

Disturbance Regimes. Fire and drought have probably been the principal historical disturbances.

Land Use. Natural vegetation has been converted to agricultural crops or pasture on about 90 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region.

Section 315C—Rolling Plains

Geomorphology. This Section is in the Central Lowlands geomorphic province. Landforms originated from platform uplift of continental sediments deposited previously into a shallow inland sea, followed by a long period of erosion. These processes resulted in a moderately dissected landscape. About 80 percent of this Section is equally divided between irregular plains and tablelands. Smaller areas of smooth plains and plains with hills are also present. Elevation ranges from 1,640 to 2,950 ft (500 to 900 m). Local relief in most of the Section ranges from 100 to 300 ft. Smaller areas are present where local relief ranges from 300 to 500 ft.



Flat terrain near Odessa, Texas, dominated by sparse cover of low grasses. Rocks beneath this landscape formed in a "Permian Basin" from which crude oil is now extracted.

Lithology and Stratigraphy. Rocks were formed during the Paleozoic and Mesozoic Eras. Geologic strata consist of about equal amounts of Permian marine deposits and Triassic continental deposits (sandstone). A small area of Permian continental deposits (sandstone, shale, and limestone) is also present.

Soil Taxa. Soils are Ustolls, Ustalfs, and Ochrepts. Most soils are on uplands and include Argiustolls, Paleustolls, and Natrustolls, Haplustalfs, Paleustalfs, and Ustochrepts. Localized areas of Ustifluvents are on flood plains. These soils have a thermic temperature regime, a ustic moisture regime, and mixed mineralogy. Most soils are deep, well drained, variable in texture, and have limited moisture for use by vegetation during part of the growing season.

Potential Natural Vegetation. Küchler classified vegetation as mesquite-buffalo grass. The predominant vegetation form is medium-tall grassland with a sparse shrub cover. The vegetative community consists of sand and little bluestems and sagebrush.

Fauna. The faunal community consists of species suited to a semi-arid environment. Large to medium-size mammals include coyote, ringtail, ocelot, and collared peccary. Typical smaller herbivores include desert cottontail, hispid pocket mouse, Texas kangaroo rat, Texas mouse, desert shrew, and rock squirrel. Bison and black-footed ferret are historically associated with this Section. Domesticated cattle are the most common large herbivore. Birds of thickets and grasslands include black-capped vireo, Harris' sparrow, scaled quail, golden-fronted woodpecker, and pyrrhuloxia. Amphibians include Couche's spadefoot toad, Great Plains narrow-mouthed frog, green toad, red-spotted toad, and Texas toad. The spotted chorus frog, yellow-mud turtle, and Texas map turtle are in wetter areas. Common reptiles include lesser earless lizard, crevice spiny lizard, Texas spotted whiptail, Great Plains skink, prairie skink, four-lined skink, western hook-nosed snake, and plains black-headed snake.

Climate. Precipitation averages 20 to 30 in (500 to 750 mm). Temperature averages 57 to 64 °F (14 to 18 °C). The growing season lasts 185 to 230 days.

Surface Water Characteristics. There is a low density of small intermittent streams and few associated rivers, all with low volume of water flowing at low velocity. A dendritic drainage pattern has developed. Major rivers include the Colorado and Brazos.

Disturbance Regimes. Fire and drought have probably been the principal historical disturbances.

Land Use. Natural vegetation has been converted to agricultural crops or pasture on much of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region.

Section 315D—Edwards Plateau

Geomorphology. This Section is in the Great Plains geomorphic province. The predominant landform consists of a broad, extensive flat plain formed by fluvial sedimentation of continental erosional products from adjacent mountain ranges, followed by sheet erosion and transport; these processes resulted in a region of moderate dissection. About 90 percent of this Section consists of landforms equally divided between smooth plains and tablelands having moderate relief. Also included are smaller areas of open high hills, high hills, and plains with hills. Elevation ranges from 650 to 4,000 ft (200 to 1,200 m). Local relief in most of the Section ranges from 100 to 300 ft (30 to 90 m). In a small area of hills, relief ranges from 300 to 500 ft (90 to 150 m).

Lithology and Stratigraphy. Rock units in this Section were formed during the Precambrian (10 percent), Paleozoic (30 percent), and Mesozoic (60 percent) Eras. Precambrian strata consist of metamorphic rocks of paragneiss and schist structures and plutonic and intrusive rocks of granitic composition. Paleozoic strata consist of a mixture of Cambrian (carbonates) and lower Ordovician marine deposits (carbonates). Mesozoic strata consist of Cretaceous marine deposits (limestone and sandstone).

Soil Taxa. Soils are mostly Ustolls. Calciustolls are on limestone hills and plateaus. Chromusterts are on outwash plains and broad plateaus. Ustochrepts are on marl and chalk hills. Haplustolls are on stream deposits of valley floors. These soils have a thermic temperature regime, a ustic moisture regime, and carbonatic or montmorillonitic mineralogy. Soils are generally shallow, fine textured, and have limited soil moisture for use by vegetation during parts of the growing season.

Potential Natural Vegetation. Küchler classified vegetation as juniper-oak savanna and mesquite-acacia-savanna. The predominant vegetation form is mid to short grasslands and evergreen scale-leaved woodlands with a sparse cover of drought-deciduous shrubs. A mixture of species may occur, including blackjack oak, red cedar, mesquite, live oak, and species of mid and short grass grasslands.

Fauna. Common large to medium size herbivores and carnivores include coyote, ringtail, coati, hog-nosed skunk, ocelot, and collared peccary. Smaller herbivores include Mexican ground squirrel, white-ankled mouse, and prairie vole. Bison are historically associated with this Section. Domesticated cattle are the most common large herbivores. Birds of thickets typically found here include scaled quail, golden-fronted woodpecker, golden-cheeked warbler, pyrrhuloxia, and long-billed thrasher. Amphibians include Couche's spadefoot toad, Rio Grande leopard frog, Great Plains narrow-mouthed frog, green toad, Texas toad, spotted chorus frog, barking frog, cliff chirping frog, and Texas map turtle. A number of salamanders in this Section have a very restricted range: San Marcas, Texas, Cormal blind, Valdina Farms, and Texas blind. Typical reptiles include Mediterranean gecko,

spot-tailed earless lizard, keeled earless lizard, Texas spiny lizard, Great Plains skink, and four-lined skink.

Climate. Annual precipitation ranges from 15 to 30 in (375 to 750 mm). Average temperature is 64 to 68 °F (18 to 20 °C). The growing season lasts 230 to 270 days.

Surface Water Characteristics. A low density of small intermittent and occasional perennial streams occurs here. All generally have a low volume of water flowing at low velocity, except along the plateau escarpment, where flow rates can be high. A dendritic drainage pattern has developed. Major rivers include the Brazos and Colorado.

Disturbance Regimes. Fire and drought have probably been the principal historical disturbances.

Land Use. Natural vegetation has been changed to agricultural crops or pasture on about 90 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region.

Section 315E—Rio Grande Plain

Geomorphology. This Section is in the Coastal Plains geomorphic province. The predominant landform in this Section is a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Elevation ranges from 80 to 1,000 ft (25 to 300 m). Local relief in most of the Section ranges from 100 to 300 ft (30 to 90 m).

Lithology and Stratigraphy. Rocks formed during the Cenozoic Era. These strata consist of Tertiary marine deposits (glauconitic, calcareous, fossiliferous layers with lignitic sandy and argillaceous deposits).

Soil Taxa. Soils are Usterts, Torrerts, and Ustalfs. Pellusterts are on plains over clayey marine sediments. Paleustalfs are on eolian plains. Torrerts, Haplustolls, Calciustolls, Paleustalfs, and Haplustalfs are on plains. Calciustolls and Calciorthids are on plains over marine sediments. Soils have a hyperthermic temperature regime, a ustic or aridic moisture regime, and mixed mineralogy. Soils are mostly deep, fine to coarse textured, well drained, and have limited soil moisture for use by vegetation during the growing season.

Potential Natural Vegetation. Küchler classified vegetation as mesquite-acacia-savanna and ceniza shrub. The predominant vegetation form is short grassland with a sparse cover of drought deciduous shrubs. Species include mesquite, cactus, and tall and mid grasses. Live oaks and cottonwoods may be present along stream banks.

Fauna. Typical large to medium size herbivores and carnivores include coyote, ringtail, hog-nosed skunk,

and ocelot. Smaller herbivores include Mexican ground squirrel, Texas pocket gopher, and southern plains woodrat. Bats typical of this Section include the ghost-faced and Sanborn's long-nosed. Bison, jaguar, and jaguarundi are historically associated with this Section. This Section and adjacent 315E form the northern range of a number of birds common to Mexico and South America. Typical birds include chachalaca, green kingfisher, pauraque, elf owl, white-winged dove, red-billed pigeon, black-headed oriole, kiskadee flycatcher, yellow-green vireo, Lichtenstein's oriole, tropical kingbird, beardless flycatcher, buff-bellied hummingbird, green jay, long-billed thrasher, and white-collared seedeater. Amphibians include Mexican burrowing toad, Rio Grande leopard frog, sheep frog, giant toad, spotted chorus frog, Mexican tree frog, Rio Grande chirping frog, and Berlandier's tortoise. Reptiles include Texas banded gecko, reticulate collared lizard, spot-tailed earless lizard, keeled earless lizard, blue spring lizard, mesquite lizard, rose-bellied lizard, Laredo striped whiptail, black-striped snake, indigo snake, speckled racer, and cat-eyed snake.

Climate. Precipitation ranges from 17 to 30 in (420 to 750 mm), decreasing from east to west and occurring mostly during May and June. Temperature averages 70 to 72 °F (21 to 22 °C). The growing season lasts 260 to 310 days.

Surface Water Characteristics. A sparse density of small to medium intermittent streams is present in a dendritic drainage pattern. Major rivers include the Rio Grande and Nueces.

Disturbance Regimes. Drought has probably been the principal historical disturbance.

Land Use. Natural vegetation has been converted to dry-land pasture for cattle grazing on about 90 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region.

Section 315F—Southern Gulf Prairies and Marshes

Geomorphology. This Section is in the Coastal Plains geomorphic province. The predominant landform consists of a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto a submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore-zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation ranges from sea level to 160 ft (0 to 50 m). Local relief ranges from 0 to 50 ft (0 to 18 m).

Lithology and Stratigraphy. Rock units formed during the Cenozoic Era. These strata consist of Quaternary marine deposits of non-glacial sand, silt, and clay.

Soil Taxa. Soils are Aquepts, Aquolls, and Aquepts. Psammaquepts, Udipsamments, Fluvaquepts, and Salorthids are on barrier islands and long bays. Haplaquolls, Natraqualls, Pelluderts, and Pellusterts are on low coastal terraces. Ochraqualls, Albaqualls, and Paleudalfs are found on plains. Haplaquolls, Haplaquepts, and Fluvaquepts are on coastal flats and flood plains. These soils have a hyperthermic and thermic temperature regime, an aquic moisture regime, and montmorillonitic, mixed, or siliceous mineralogy. Soils are fine to coarse textured, saline, and mostly poorly drained with high water tables.

Potential Natural Vegetation. Küchler classified vegetation as bluestem-sacahuista prairie and southern cordgrass prairie. The predominant vegetation form is tall grassland with little tree cover. Grasslands dominate areas inland from the coast and consist of little bluestem, indiangrass, switchgrass, and big bluestem. Occasional areas of live oak are present. Poorly drained areas along the coast support freshwater and saltwater marsh vegetation of sedges, rushes, saltgrass, and cordgrass.

Fauna. The faunal communities typically include coyote, ringtail, hog-nosed skunk, ocelot, and collared peccary. Smaller mammals include Mexican ground squirrel, Texas pocket mouse, northern pygmy mouse, and southern Plains woodrat. Birds of freshwater marshes, lakes, ponds, and rivers include reddish egret, white-faced ibis, black-billed whistling duck, white-fronted goose, and olivaceous cormorant. Reptiles and amphibians include eastern spadefoot toad, Gulf coast toad, American alligator, diamondback terrapin, spiny-tailed iguana, Texas horned lizard, Texas spotted whiptail, and indigo snake.

Climate. Precipitation ranges from 25 to 55 in (620 to 1,400 mm). Temperature averages 68 to 70 °F (20 to 21 °C). The growing season lasts 280 to 320 days.

Surface Water Characteristics. A low density of small to medium perennial streams is present in this Section. The water table is high in many areas, resulting in poor natural drainage and abundance of wetlands. A poorly defined drainage pattern has developed on very young alluvial plains. There is an abundance of palustrine systems with seasonally high water levels. This Section adjoins the West Indian Marine and Estuarine Provinces.

Disturbance Regimes. Ocean tides and grazing have probably been the principal historical disturbance. Climatic influences include occasional hurricanes.

Land Use. Natural vegetation has been changed for agricultural crops on about 40 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region.

Province M313—Arizona-New Mexico Mountains Semi-Desert - Open Woodland - Coniferous Forest - Alpine Meadow

Two Sections have been delineated in this Province: M313A—White Mountain-San Francisco Peaks-Mogollon Rim; and M313B—Sacramento-Manzano Mountain. These Sections are located in Arizona and New Mexico. The area of these Sections is about 50,200 mi² (130,000 km²).

Section M313A—White Mountain-San Francisco Peaks-Mogollon Rim

Geomorphology. Located in the Colorado Plateau physiographic province, this section is in central and eastern-central Arizona and west-central New Mexico. Geomorphic processes active in this Section include Cenozoic volcanism, including basaltic lava flows, cinder cone eruptions, and volcanic ash. Major landforms include mountains, plains, plateaus, and hills. Major landform features include the San Francisco Mountains, White Mountains, and Jemez and Mogollon Mountains. Elevation ranges from 6,000 to over 12,600 ft (1,820 to 3,860 m).

Lithology and Stratigraphy. There are Quaternary and upper Tertiary volcanic igneous rocks, with Middle

Tertiary to Cretaceous metamorphics and Mesozoic sedimentaries.

Soil Taxa. Soils include Eutroboralfs and Ustochrepts with frigid soil temperature regimes and ustic soil moisture regimes. There are Glossoboralfs, Dystrochrepts, and Udic Argiborolls in frigid to udic regimes and Cryoboralfs, and Cryochrepts in cryic to udic regimes. There is a limited amount of pergelic to udic Cryumbrepts.

Potential Natural Vegetation. Predominant vegetation consists of ponderosa pine and gambel oak in frigid soil temperature and ustic soil moisture regimes, and white fir, Douglas-fir in frigid-udic regimes. Engelmann spruce and corkbark fir are in cryic-udic regimes and mountain avens are in pergelic-udic regimes.

Fauna. Reserved.

Climate. Precipitation ranges from 20 to over 32 in (500 to over 800 mm) annually, with more than half of the precipitation falling during the winter. Temperature ranges from less than 32 to 45 °F (less than 0 to 7 °C). The growing season ranges from less than 50 to 110 days, and winters are cold.



Mogollon Mountains in Gila National Forest, New Mexico.

Surface Water Characteristics. This Section is the primary watershed for much of Arizona and western New Mexico. Several large streams are perennial. Much of the water is stored in reservoirs, and small artificial lakes are common. Ground water is limited and usually occurs at great depths.

Disturbance Regimes. Natural fires occurred in ponderosa pine about every 3 to 10 years, but have been prevented recently. This has led to a higher canopy cover and increased fuel loads, resulting in a less resilient ecosystem and increased hazard of wildfire. Much of this area is covered with timber, with rangeland and recreation being secondary uses.

Land Use. Reserved.

Cultural Ecology. This diverse Section encompasses primarily the mountainous ponderosa pine and transition zones of central Arizona and western New Mexico. Human groups have utilized this Section's well-watered upland valleys and meadows, high mesas, and more sparsely forested basins and ranges for the full extent of human prehistory in the Southwest. Paleo-Indian and Archaic peoples utilized the mountains seasonally for hunting and gathering, as did later populations. Early agriculturalists made use of a wide variety of settings, including upland valleys, for their pithouse villages and planting areas. In later times, settlements concentrated more in the bottomlands of major drainages, but shifts to higher elevations occurred at various times and in various places in response to climatic fluctuations, population growth, and defensive concerns. The uplands include manifestations of a wide range of cultural traditions, including the Sinagua, Mogollon, Mimbres, and eastern and western Anasazi. By the mid-1300's, however, most of the area was abandoned as permanent or seasonal settlements. Sometime around or before the Spanish entrada into the Southwest, Athabascan speakers made their appearance; Apache and Navajo continued to use the mountains for sustenance and for refuge well into the 19th century.

Spanish and Mexican use of most mountain areas was limited due to the presence of Apache and Navajo. In New Mexico, the Jemez Mountains were used by both Pueblos and Hispanic villagers for hunting, grazing, and fuel wood gathering in Colonial times. The discovery of mineral resources in the mid-1800's greatly increased American interest in the mountains, and military campaigns eventually removed the Apache and Navajo to reservations. The coming of the railroads in the 1880's made large-scale logging possible, especially evident in the White Mountains and Zuni Mountains. Ranching, mining, and logging were important pursuits in the early part of the 20th century, and continue today. Recreation and wilderness values are equally important on public lands. The mountains, particularly peaks like the San Francisco Peaks and Mt. Taylor, hold special cultural and religious significance for many contemporary Pueblos and tribes who continue to use the mountains for economic and ceremonial purposes. This Section includes portions of

the White Mountain Apache, Navajo, and Jicarilla Apache Reservations, as well as Acoma, Laguna, Jemez, and Zia pueblos.

Compiled by Southwestern Region.

Section M313B—Sacramento-Manzano Mountain

Geomorphology. This Section is in the Basin and Range physiographic province; it is located in central and south-central New Mexico. Major landforms are mountains, hills, plains, and scarps. Major landform features are the Sacramento, Manzano and Sandia Mountains and the Canadian Escarpment. Elevation ranges from 6,000 to 11,000 ft (2,130 to 3,690 m).

Lithology and Stratigraphy. There are Paleozoic sedimentary and Cenozoic aged igneous rocks and a few metamorphic rocks.

Soil Taxa. Soils include Eutroboralfs, Glossoboralfs, Dystrochrepts, Ustochrepts, Argiustolls, Calciustolls, Haplustolls, and Ustorthents with mesic and frigid temperature regimes and ustic and udic soil moisture regimes. A few Cryoboralfs and Cryochrepts occur with cryic soil temperature regimes and udic soil moisture regimes.

Potential Natural Vegetation. Vegetation consists of ponderosa pine in frigid soil temperature regimes and ustic and udic soil moisture regimes, Douglas-Fir in frigid-udic regimes, pinyon-juniper in mesic-ustic regimes, and Engelmann spruce, and subalpine fir in cryic-udic regimes. A few areas support grey oak at the lowest elevations.

Fauna. Reserved.

Climate. Precipitation ranges from 12 to 35 in (305 to 900 mm), with less than half of the precipitation falling during the winter. Temperature averages 40 to 57 °F (4 to 8 °C); winter temperatures vary throughout this Section. The growing season lasts less than 70 to 170 days.

Surface Water Characteristics. This Section supplies much of the water to the Rio Grande and Pecos Valley basins. Several streams are perennial.

Disturbance Regimes. Natural fire regime averages 3 to 10 years of frequency in ponderosa pine forests. Much of this area is covered with timber, with some areas of commercial quality. Another use of land is as range.

Land Use. Reserved.

Cultural Ecology. The earliest human occupation of the Sacramento-Manzano Mountain Section was characterized by an emphasis on big game hunting supplemented with gathering wild plant foods. Evidence for these activities is primarily restricted to the lower elevations and the base of the mountains. Around 6000

B.C., a gradual climate change from cooler and wetter to drier conditions resulted in a change of subsistence patterns. Highly mobile populations hunted and gathered a variety of resources throughout the region. The pinon-juniper zone was intensely exploited for both hunting and gathering. The mixed conifer forests were utilized to some extent for hunting and religious purposes, but the climate and scarcity of resources resulted in only sporadic use. As agriculture became important during the past 2000 years, most of the inhabitants became more sedentary and populations increased. Villages tended to be located close to water in the pinon-juniper woodland and lower alluvial fans at the base of the mountains. Athabascan groups entered the area sometime before the 1600's, utilizing many of the same resources; by the mid 1700's, Comanches occupied the plains immediately to the east. Today, Native Americans continue to use the mountains for gathering and ceremonial purposes.

The earliest historic settlement began in the late 1500's with the Spaniards. A few villages were established in the foothills of the Manzanos, Sandias, and near the headwaters of the Canadian and Pecos Rivers, but

the Apaches kept most European settlers out of the Sacramentos and mountain ranges to the south. These settlers concentrated on the pinon-juniper woodlands and grasslands for hunting, fuel wood gathering, post cutting, and small subsistence farming. Beginning in the late 1800's, discoveries of gold and an increase in European settlement throughout the mountains resulted in more intensive use of the higher elevations for mining, logging, and ranching activities. Most of the homesteads and villages were located in the larger valleys or on the eastern slopes of the mountains near permanent water sources. By the turn of the century, logging dominated the activities in the mixed conifer zone, with ranching still playing an important role throughout the mountains. Currently, the area continues to consist primarily of small rural communities, with logging, fuel wood gathering, ranching, hunting, and recreation as the primary subsistence base. Anglo, Hispanic, and Mescalero Apache cultures are present. Recreational use has increased dramatically over the past few decades, particularly near the larger cities.

Compiled by Southwestern Region.

Province 321–Chihuahuan Semi-Desert

Two Sections have been delineated in this Province: 321A–Basin and Range; and 321B–Stockton Plateau. These Sections are located in the southwestern conterminous States, including parts of Arizona, New Mexico, and Texas. The area of these Sections is about 85,200 mi² (220,700 km²).

Section 321A–Basin and Range

Geomorphology. This area, which is in the Basin and Range physiographic province, is located in southeast Arizona and southwest and central New Mexico. Relatively recent episodes of continental rifting, volcanism, erosion, and sedimentation have dominated this Section. Oligocene faulting created the Rio Grande rift in New Mexico and west Texas and initiated volcanism. Subsequent Miocene composite volcanoes emitted silicic lava and ash. Along with Pliocene and Pleistocene mass wasting and cyclic erosion events, and associated with glacial cycles farther north, this combination of processes gradually filled the basins with deep sediments from adjacent mountain ranges. Current erosion cycles dissect these deposits and continue to modify the rift valley

through transport and deposition processes. Various landforms comprise about equal areas: (1) plains with low mountains consisting of 50 to 80 percent of gently sloping area and local relief of 1,000 to 3,000 ft (300 to 900 m); (2) plains with high hills where relief is 1,000 to 3,000 ft (300 to 900 m); (3) open high hills with relief of 500 to 1,000 ft (150 to 300 m); and (4) tablelands with moderate relief averaging 100 to 300 ft (30 to 90 m). Elevation ranges from 2,600 to 5,500 ft (800 to 1676 m).

Lithology and Stratigraphy. Geologic strata consist of an undifferentiated mixture of Quaternary marine deposits, Miocene volcanic rocks, lower Tertiary volcanic rocks, and Lower Cretaceous marine deposits; Permian marine deposits of Ochoan and Guadalupian series; Paleocene continental deposits; Upper Cretaceous marine deposits; Precambrian plutonic and intrusive granitic rocks; Quaternary volcanic rocks; Permian continental deposits of Wolfcampian age, and Miocene felsic volcanic rocks; upper Paleozoic marine deposits; Precambrian sedimentary rocks of Pahrump and Unkar groups; Precambrian Mazatal quartzite, Yavapai series, pinal schist, and metavolcanic formations.



The Chihuahuan Desert in the Basin and Range Section of southeastern Arizona.

Soil Taxa. Types are mostly Torriorthents with Calciorthids, Haplargids, and some Alfisols (10 percent) and Mollisols (10 percent) with a thermic temperature regime, an aridic moisture regime, and mixed or carbonatic mineralogy.

Potential Natural Vegetation. Küchler mapped vegetation as trans-Pecos shrub savanna (*Flourensia-Larrea*); grama-tobosa desert grasslands; oak-juniper woodland; and mesquite-tarbrush desert scrub.

Fauna. Reserved.

Climate. Precipitation ranges from 8 to 13 in (200 to 320 mm); it occurs mostly during July and August. Temperature ranges from 55 to 70 °F (13 to 20 °C) and winters are mild. The growing season lasts 200 to 240 days.

Surface Water Characteristics. There is a low density of intermittent streams and very few associated rivers, most of which originate in distant mountainous areas. Flow rates are low to moderate, except during periods of heavy rain, when large amounts of surface runoff can occur. Dendritic drainage pattern has developed on dissected mountain slopes, largely without bedrock structural control. Playa lakes are common following periods of rains, but are ephemeral in the hot, dry climate prevalent in this Section.

Disturbance Regimes. Drought has probably been the principal historical source of disturbance.

Land Use. Land use includes range for cattle grazing on about 90 percent of the area.

Cultural Ecology. The Basin and Range Section is a physiographically diverse area characterized by expansive playas and open grassland basins cut by steep, rugged mountain, mesa, and canyon terrain. Humans have been utilizing the area for 8,000 to 10,000 years, although evidence of occupation prior to 7,000 B.C. remains scarce and scattered. Paleo-Indian materials are especially prevalent, however, from the foothills of the Tularosa Mountains. The area was widely utilized by Cochise and Oshara Tradition Archaic populations between 7,000 B.C. and 200 A.D. Site distribution points to a highly mobile hunting and gathering nomadic subsistence pattern initially, followed by use of increasingly smaller areas and a seasonal cycle of upland and lowland exploitation. Puebloan use and occupation were most prevalent between 200 and 1150 A.D. in the south and 200 and 1400 A.D. in the north. Southern basin, range, and mountain areas supported the Mogollon culture, while more northern mountain areas also included the southern fringe of the Anasazi tradition. Puebloan settlement reflected gradual movement toward major drainages and waterways over time. Basin and range deserts were widely used for wild plant procurement, agriculture, and settlement.

References to the Apache appear in 16th century Spanish documents and later historic accounts. Spanish expeditions passed through the area, but major settlements were restricted to the Rio Grande and the area east of the Mogollon and Tularosa Mountains. Livestock ranching and mining gained prominence in the 1800's. Gold, silver, copper, and turquoise were mined in the Mogollon, Burro, and Black Range Mountains of New Mexico. Introduction of the railroad in the 1800's witnessed an influx of European settlement along the Rio Grande, the southern Burro Mountains (Deming, Lordsburg, and Silver City, New Mexico) and more northern reaches of the Mogollon Mountains. In more northern, remote mountain areas, small ranching, mining, and timber-related settlements were established along major rivers and ephemeral drainages. Ranching and tourism flourish in the area today, and both Anglo and Hispanic cultures influence contemporary life.

Compiled by Southwestern Region.

Section 321B—Stockton Plateau

Geomorphology. This Section is in the Great Plains geomorphic province. The predominant landform consists of open high hills with smaller areas of tablelands. These landforms were formed by fluvial sedimentation of continental erosional products from adjacent mountain ranges, which was followed by sheet erosion and transport. These processes resulted in a region of shallow dissection. Elevation ranges from 2,600 to 4,500 ft (800 to 1,300 m). Local relief in most of the Section ranges from 500 to 1,000 ft. Relief in a small area of tablelands ranges from 300 to 500 ft.

Lithology and Stratigraphy. Rocks were formed during Paleozoic (35 percent), Mesozoic (40 percent), and Cenozoic (25 percent) Eras. Paleozoic strata consist of Pennsylvanian marine deposits. Mesozoic strata consist of nondifferentiated mixture of Lower and Upper Cretaceous marine deposits (limestone, and sandstone). Cenozoic strata consist of lower Tertiary volcanic rocks of high alkalic content.

Soil Taxa. Soils are Argids and Orthids. Haplargids, Paleargids, and Calciorthids are on uplands, piedmont plains, and dissected terraces. Calciorthids, Ustolls, and Torriorthents are on uplands with shallow depths to bedrock. Paleorthids are on mesas and terraces. Gypsiorthids are in closed basins. Natragids and Torrerts are on basin floors. Torrifluents are on flood plains and Torripsamments are on sandy uplands. These soils have a thermic temperature regime, aridic moisture regime, and mixed or carbonatic mineralogy. Soils are well drained, shallow to deep, and medium textured. Soil moisture is limited for use by vegetation during most of the growing season.

Potential Natural Vegetation. Küchler classified vegetation as trans-Pecos shrub savanna (*Flourensia-Larrea*); with juniper and redcedar woodlands. The

predominant vegetation form is short to mid height grasslands with sparse cover of drought-deciduous and scale-leaved shrubs and small trees. Species include desert shrubs in association with short to mid height grasses and oak savannas.

Fauna. Typical large to medium size herbivores and carnivores include pronghorn, coyote, swift fox, ringtail, hooded skunk, ocelot, and collared peccary. Smaller herbivores include desert shrew, desert cottontail, Mexican ground squirrel, yellow-faced pocket gopher, Nelson's pocket mouse, and Merriam's kangaroo rat. Several bats, western mastiff and yuma myotis, are present here. Birds of grasslands include bronzed cowbird, Baird's sparrow, and white-necked raven. Birds of thickets include black-capped vireo, scaled quail, Harris' hawk, Inca dove, cave swallow, golden-fronted woodpecker, and pyrrhuloxia. Amphibians include Couche's spadefoot toad, western spadefoot toad, Rio Grande leopard frog, Great Plains toad, red-spotted toad, spotted chirping frog, and Mexican mud turtle. Reptiles include Texas banded gecko, Big Bend gecko, desert spring lizard, canyon lizard, crevice spiny lizard, gray checkered whiptail, little striped whiptail, plateau spotted whiptail, checkered whiptail, Texas-Pecos rat snake, gray-banded kingsnake, Big Bend patch-nosed snake, Mexican black-nosed snake, Big Bend

black-headed snake, rock rattlesnake, and black-tailed rattlesnake.

Climate. Precipitation ranges from 8 to 13 in (200 to 320 mm). Temperature ranges from 55 to 64 °F (13 to 18 °C). The growing season lasts 200 to 240 days.

Surface Water Characteristics. This Section has a low density of intermittent streams that originate in nearby mountainous areas and flow mainly following rains. Major river systems include the Rio Grande and Big Canyon. Flow rates are low except during periods of heavy rain, when large amounts of surface runoff can occur. Dendritic drainage pattern has developed. Playa-type lakes are present following rains but quickly dry up, leaving high salt concentrations.

Disturbance Regimes. Drought and flash floods are the principal types of natural disturbance.

Land Use. Reserved.

Cultural Ecology. Reserved.

Compiled by Southern Region.

Province 322—American Semi-Desert and Desert

Three Sections have been delineated in this Province: 322A—Mojave Desert; 322B—Sonoran Desert; and 322C—Colorado Desert. These Sections are located in California and Arizona. The area of these Sections is about 87,700 mi² (227,100 km²).

Section 322A—Mohave Desert

Geomorphology. This area comprises widely separated short ranges in desert plains. It contains isolated mountains, plateaus, alluvial fans, playas, basins, and dunes. Elevation ranges from 300 ft below sea level to 11,000 ft above sea level (-91 to 3,344 m). This Section is in the Basin and Range geomorphic province.

Lithology and Stratigraphy. There are Cenozoic nonmarine sedimentary and granitic rocks and alluvial deposits, and Precambrian rocks of all types.

Soil Taxa. Soils include Aridisols and Entisols in combination with thermic and hyperthermic soil temperature regimes and aridic soil moisture regime on foothills and valleys. This Section contains areas with salt-affected soils. Aridisols and Entisols in combination with mesic and frigid soil temperature regimes, and aridic and xeric soil moisture regimes occur on mountains.

Potential Natural Vegetation. K  chler mapped vegetation as Mojave creosote bush, juniper-pinyon woodland, desert saltbush, and Joshua tree scrub. Predominant potential natural communities include creosote bush, blackbush, greasewood and saltbush series on basins, plains, and hills; Joshua Tree series on plains and hills; and basin sagebrush, western juniper and pinyon pine series on mountains.

Fauna. Mammals include desert bighorn sheep, desert kit fox, coyote, spotted skunk, spotted bat, black-tailed jackrabbit, ground squirrels, kangaroo rat, and white-footed mouse. Birds includes eagles, hawks, owls, quail, roadrunners, finches, warblers, and orioles. Reptiles include desert tortoise, several species of rattlesnakes, and chuckawalla lizard.

Climate. Precipitation ranges from 3 to 10 in (80 to 250 mm). It mostly occurs as scattered high intensity storms of short duration. Temperature ranges from 50 to 75   F (10 to 24   C). The growing season lasts 200 to 300 days.

Surface Water Characteristics. There are mostly bedrock controlled channels in mountains that carry seasonal flows to alluvial channels below. Most channels terminate in basins within the Section. Some of the eastern part of this Section drains toward the Colorado River. A few reservoirs occur on the Colorado River.

Disturbance Regimes. Areas with less than about 8 in (200 mm) of rainfall rarely support enough vegetation to carry a fire. Fire occurrence in areas receiving more than about 8 in (200 mm) has been influenced by introduced grasses. Fires are variable in frequency and intensity. Flash floods are commonly associated with the irregular occurrence of precipitation events.

Land Use. Composition and successional sequence of some communities has changed because of plant and animal species introduced between the late 1800's and early 1900's related to mining and grazing. Since the early 1900's, significant effects on some plant and animal species occur at widely scattered locations associated with military testing, recreational activities, and rapidly expanding urbanization.

Cultural Ecology. Humans have been utilizing the area for some 10,000 years; the early Lake Mohave Paleo-Indian hunting assemblage is well documented at sites along the shores of Pleistocene Lake Mojave. After the end of the Pleistocene, prehistoric assemblages reflect extensive practice of seasonal rounds for resource gathering. In the Section's southern portion, agricultural practices from Colorado River culture influences spread into the area during late prehistoric times, after 1000 A.D. Historic mining of hard rock minerals and borax altered much of the landscape. Contemporary attitudes and beliefs are varied; lifestyle is rural. The economy emphasizes government employment, mining, ranching, and recreation.

Compiled by Pacific Southwest Region.

Section 322B—Sonoran Desert

Geomorphology. This Section is in the Basin and Range physiographic province. There are widely separated short ranges in desert plains. This Section, which is located in southwestern Arizona, has as its major landforms, plains, fans, and terraces. Elevation ranges from 300 to 3,500 ft (91 to 1,064 m).



Sonoran Desert landscape in the Tonto National Forest with characteristic vegetation, which includes the saguaro cactus.

Lithology and Stratigraphy. There are Cenozoic nonmarine sedimentary and granitic rocks and alluvial deposits, and Precambrian rocks of all types.

Soil Taxa. Soil include Calciorthids, Haplargids, and Torrifuvents in combination with thermic and hyperthermic soil temperature regimes and aridic soil moisture regime.

Potential Natural Vegetation. Potential natural communities include palo verde, creosote bush, saguaro, mesquite series, and bursage.

Fauna. Reserved.

Climate. Precipitation ranges from 3 to 8 in (80 to 200 mm). It is bimodal, occurring as winter rain and high intensity summer thunderstorms, with more than half of the annual precipitation falling during the winter. Temperature ranges from 61 to 75 °F (16 to 24 °C) and winters are mild. The growing season lasts 250 to 350 days.

Surface Water Characteristics. This Section has mostly bedrock controlled channels in mountains that

carry seasonal flows to alluvial channels below. Channels terminate in basins or the Colorado River.

Disturbance Regimes. Composition and successional sequence of some communities have changed because of plant and animal species introduced between the late 1800's and early 1900's related to mining and grazing. Since the early 1900's, significant effects on some plant and animal species occur at widely scattered locations associated with military installations, recreational activities, and rapidly expanding urbanization. Flash floods are commonly associated with summer precipitation events.

Land Use. Reserved.

Cultural Ecology. Water is the critical resource of the Sonoran Desert, and its availability defines two Subsections. the Lower Colorado River Valley and the Arizona Uplands. The Lower Colorado River Valley, characterized by creosote bush and white bursage, occupies the western portion of the Sonoran Desert. Over time, it has been inhabited by Clovis, Amargosa, Hohokam, Patayan, Yuman, and Hia-Ced and Tohono O'odham populations. The Valley Subsection is low, hot,

and dry (except for the Colorado River) and aboriginal settlement patterns involved widespread foraging or agriculture in the basins during the rainy season. During dry seasons, populations concentrated around water sources. The Arizona Uplands are more mesic and are characterized by paloverde and saguaro vegetation. Prior to Euro-American colonization, it was occupied by Clovis, Cochise culture, Hohokam, and Tohono O'odham populations. Aboriginal populations became more dependent on agriculture, and permanent villages were located along major streams such as the Santa Cruz and Salt Rivers. In the Phoenix basin, major Hohokam communities flourished, based on a complex system of irrigation canals.

Although Coronado may have crossed the western edge of the Section in 1540, it was not until the late 17th century that missions were established by the Spanish; settlements appeared even later. Spanish and Mexican settlement did not spread north of Tucson or away from permanent streams, and was based on grazing, mining, and agriculture. Anglo-American settlement has shared this economic base and also focused on the major drainages. Paleo-environmental reconstructions have been hampered by the lack of good dendro-climatological data, and extreme local variability in responses to regional trends. Historic change does appear less extensive than in grassland Sections. Arroyo cutting has occurred, and mesquite bosques have replaced cienegas along streams. Overgrazing, fire suppression, and climatic variation are debated as the cause. Today this Section is characterized by rapid population growth in urban areas where economies are dominated by commerce, tourism, light manufacturing, and the construction industry. Contemporary cultures include Anglo-American, Mexican-American, the Tohono O'odham (Pima and Papago), and the San Carlos Apache.

Compiled by Southwestern Region.

Section 322C—Colorado Desert

Geomorphology. There are alluvial slopes, basin, dunes, and delta plain (Gulf of California). Elevation ranges from 230 feet below sea level to 1,000 ft (-70 to 304 m). This Section is in the Basin and Range geomorphic province.

Lithology and Stratigraphy. Cenozoic alluvial deposits occur.

Soil Taxa. Soils include Aridisols and Entisols with hyperthermic soil temperature regime and aridic soil moisture regime.

Potential Natural Vegetation. Küchler mapped vegetation as Sonoran creosote bush, Salton Sea saltbush,

and oasis scrub-woodland. Predominant potential natural communities include creosote bush and mesquite series.

Fauna. Mammals include desert bighorn sheep, desert kit fox, coyote, spotted skunk, spotted bat, black-tailed jackrabbit, ground squirrel, kangaroo rat, and white-footed mouse. Birds includes eagles, hawks, owls, quail, white-winged dove, roadrunner, finches, warblers, and orioles. The Salton Sea provides habitat for a wide variety of waterfowl and shore birds. Reptiles include several species of rattlesnakes.

Climate. Precipitation averages 2 to 6 in (50 to 150 mm). Temperature averages 65 to 75 °F (18 to 24 °C). The growing season lasts 250 to 350 days.

Surface Water Characteristics. There are mostly bedrock controlled channels in mountains that carry seasonal flows through alluvial channels below to the Salton Sea. A few rivers that evolved from irrigation drainage water flow to the Salton Sea from Imperial and Coachella Valleys. The largest surface water feature is the Salton Sea (about 40 by 16 mi (64 by 26 km).

Disturbance Regimes. Strong winds and drifting sand are common in parts of the area. Flash floods are commonly associated with the irregular occurrence of precipitation events. Precipitation does not occur every year.

Land Use. Composition and successional sequence of some communities have changed because of plant and animal species introduced between the early 1800's and early 1900's. These introductions related to grazing, agriculture, and urbanization. Most of the Section is converted to irrigated agriculture. Increased salinity of soil and water occurs in some areas as a result of modified drainage. Rapidly expanding urbanized areas are scattered throughout the Section.

Cultural Ecology. Humans have been utilizing the area for some 10,000 years. After the end of the Pleistocene hunting traditions, Archaic assemblages reflect extensive practice of seasonal rounds for diversified hunting and gathering. Agricultural practices of Colorado River cultures spread throughout the area during late prehistoric times, after 1000 A.D. In recent historic times, large areas have been converted to irrigated agriculture. The recently formed Salton Sea has become a mecca for retirement, recreation, and development. Contemporary attitudes and beliefs are varied; lifestyle is rural. The international border and large Hispanic populations contribute to cultural diversity; Hispanic populations comprise much of the agricultural, often migrant, work force. The economy emphasizes agriculture, government employment, and recreation.

Compiled by Pacific Southwest Region.

Province 331–Great Plains-Palouse Dry Steppe

Ten Sections have been delineated in this Province: 331A–Palouse Prairie; 331B–Southern High Plains; 331C–Central High Tablelands; 331D–Northwestern Glaciated Plains; 331E–Northern Glaciated Plains; 331F–Northwestern Great Plains; 331G–Powder River Basin; 331H–Central High Plains; 331I–Arkansas Tablelands; and 331J–Northern Rio Grande Basin. These Sections are located in the north-central conterminous States, including parts of Oklahoma, Kansas, Colorado, Nebraska, Wyoming, South and North Dakota, and Montana. The area of these Sections is about 290,700 mi² (752,900 km²).

Section 331A–Palouse Prairie

Geomorphology. This Section comprises moderately to strongly dissected loess-covered basalt plains, hills with large step toes, undulating plateaus, and some river breaklands. Mountains occur in the southeast part of the Section. This Section is within the Columbia Plateau physiographic province. Elevation ranges from 1,200 to 6,000 ft (366 to 1,830 m).

Lithology and Stratigraphy. There is Tertiary basalt with some Paleozoic granitic and metasedimentary outcrops in breaklands. Granitoid rocks of the Blue Mountain uplift are evident, as well as sedimentary rocks which occur at the boundaries of the flood basalt deposits.

Soil Taxa. Soils include mesic Xerolls with some Xeralfs, Albolls, and Aquolls. These soils are generally deep, loamy to silty, and have formed in loess, alluvium, or glacial outwash. Soils in mountainous areas are shallower and contain rock fragments.

Potential Natural Vegetation. Grasslands and meadow-steppe vegetation dominated by grasses are the prototypical vegetation of the Palouse. Woodlands and forests occur in the eastern portion of the Section on hills and low mountains. The relatively arid western portion of the Section is dominated by grassland, where bluebunch wheatgrass and Idaho fescue are the most prominent. Meadow-steppe vegetation characterized by Idaho fescue and common snowberry dominates areas with more precipitation, but still too dry to support forest vegetation on deep loamy soils. Most of this meadow-steppe as well as the grassland to the west, has been converted to crop lands. Ponderosa pine woodlands and forests form the lower timberline in the eastern portion of the Section on hills and low mountains. The transition zone between forest and meadow-steppe consists of a complex interfingering between these two vegetation types. Douglas-fir series forests dominate at higher elevations in the mountains. Isolated fragments of the Western Red

Cedar series and Grand Fir series occur on sheltered north slopes in the mountains.

Fauna. Birds are typical of grasslands with intermittent riparian systems and pine hills. Grassland species include American kestrel, ring-necked pheasant, upland sandpiper, western kingbird, horned lark, black-billed magpie, western meadowlark, and savanna sparrow. Riparian system species include Lewis' woodpecker, gray catbird, western bluebird, orange-crowned warbler, northern oriole, black-headed grosbeak, and lazuli bunting. Birds which reach or nearly reach the extent of their range include mountain quail, barn owl, white-headed woodpecker, eastern kingbird, and American redstart. The bald eagle, an endangered species, also occurs around larger water bodies. Typical herbivores and carnivores include white-tail deer, mule deer, and bobcat. Smaller common herbivores include the blacktail jackrabbit and Washington ground squirrel. Rare species include the whitetail jackrabbit, and possibly the pygmy rabbit. Herpetofauna typical of this Section are the bullfrog, painted turtle, western fence lizard, and the northern Pacific rattlesnake.

Climate. Precipitation ranges from 10 to 30 in (250 to 760 mm), evenly distributed throughout fall, winter, and spring. Winter precipitation is mostly snow; summers are relatively dry. Climate is warm temperate with a maritime influence. Temperature averages 45 to 54 °F (7 to 12 °C). The growing season lasts 100 to 170 days.

Surface Water Characteristics. There are scattered coulees and deeply-incised major drainages. Loess plains have low to medium density dendritic drainage patterns. Rapid changes in runoff volumes are possible on basalt due to gain or loss of water to gravel interbeds. The Snake River flows through this Section.

Disturbance Regimes. Wind is the principal source of natural disturbance.

Land Use. Dry farming and livestock grazing occurs on about 90 percent of the area.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Section 331B–Southern High Plains

Geomorphology. This Section is in the Great Plains geomorphic province. The predominant landform is a broad, extensive flat plain formed by fluvial sedimentation of continental erosional products from adjacent mountain ranges, followed by sheet erosion and transport. These



Southern High Plains Section.

processes resulted in a region of moderate dissection. Landforms consist mostly of smooth plains with smaller areas of tablelands. Elevation ranges from 2,600 to 4,000 ft (800 to 1,200 m). Local relief ranges mainly from 100 to 300 ft (90 m). A small area of tablelands is present where relief ranges from 300 to 500 ft (90 to 150 m).

Lithology and Stratigraphy. Rocks were formed during the Paleozoic (20 percent), Mesozoic (20 percent), and Cenozoic (60 percent) Eras. Paleozoic strata consist of Permian marine deposits (shale and limestone). Mesozoic strata consists of Upper Cretaceous marine deposits (limestone and sandstone). Cenozoic strata consists of Quaternary continental deposits (poorly consolidated silt, sand, and gravel in varying proportions) and other localized marine deposits.

Soil Taxa. Soils are Ustolls and Ustalfs. Paleustolls, Argiustolls, Paleustalfs, and Haplustalfs are on uplands. Calciustolls, Haplustolls, and Paleustolls are on ridges and steeper slopes. Haplustolls occur on young valley floors. Pellusterts are in clayey playa lake basins. Calciorthids, Paleorthids, and Torriorthents are steep slopes in breaks. These soils have a mesic or thermic temperature regime, an ustic moisture regime, and mixed or carbonatic mineralogy. Soils are deep, fine to coarse textured, well drained, and have limited soil moisture for use by vegetation during parts of the growing season.

Potential Natural Vegetation. Küchler classified vegetation as sandsage-bluestem prairie and bluestem-grama prairie. The predominant vegetation form is short to mid-height grasslands. Species composition includes bluegrama, buffalograss, hairy grama, and little bluestem.

Fauna. Large to medium size herbivores and carnivores typical of this Section include pronghorn, coyote, and ringtail. Smaller herbivores include desert shrew, black-tailed prairie dog, Plains pocket mouse, silky pocket mouse, and hispid pocket mouse. Bison and black-footed ferret are historically associated with this Section. Birds of grasslands include lesser prairie chicken, Swainson's hawk, and burrowing owl. Typical reptiles and amphibians include Great Plains toad, red spotted toad, lesser earless lizard, round-tailed horned lizard, Great Plains skink, and Plains black-headed snake.

Climate. Annual precipitation averages 16 to 20 in (400 to 520 mm). Between 16 to 35 in (400 to 900 mm) of snow occurs. Temperature ranges from 50 to 57 °F (10 to 14 °C). The growing season lasts 140 to 185 days.

Surface Water Characteristics. There is a low density of small intermittent streams with low volume of water flowing at low velocity. A dendritic drainage pattern has developed on a weakly dissected plateau, largely without bedrock structural control. Major rivers include the Cimarron and North Canadian.

Disturbance Regimes. Reserved.

Land Use. Natural vegetation has been converted to agricultural crops and range for cattle grazing on about 90 percent of the area.

Cultural Ecology. Reserved.

Compiled by Southern Region and Southeastern Forest Experiment Station.

Section 331C—Central High Tablelands

Geomorphology. This Section includes broad intervalley remnants of smooth fluvial plains. Smooth loess-mantled tablelands with gently rolling slopes and major valleys are bordered by steep slopes. Broad, level flood plains and terraces occur on major rivers and streams. This Section is in Fenneman and Johnson's Great Plains geomorphic physical division. Elevation ranges from 2,625 to 3,950 ft (800 to 1,200 m).

Lithology and Stratigraphy. The Colorado part of the Section is Tertiary sandstones, siltstones, and conglomerates and Quaternary windblown dune sands and loess, with Cretaceous marine shales and Quaternary alluvium in the major drainages. The Nebraska and Kansas part of the Section is mostly Quaternary windblown dune sands and loess, some Tertiary sandstones, shales, and conglomerates, and Cretaceous shales and limestones with Quaternary alluvium in stream valleys.

Soil Taxa. This area has mesic temperature and ustic moisture regimes. Soil include Mollisols, Entisols, and Alfisols.

Potential Natural Vegetation. Küchler mapped vegetation as grama-buffalo grass prairie, bluestem-grama prairie, sandsage-bluestem prairie, and wheatgrass-bluestem-needlegrass prairie. The predominant vegetation is short grass prairie.

Fauna. Bison, wolves, and black-footed ferrets are historically associated with this Section. Present large mammals include white-tailed deer, mule deer, and a small population of pronghorn antelope. Typical small mammals include the bobcat, red fox, jackrabbit, cottontail, and prairie dog. Year-round typical avifauna include the introduced ring-necked pheasant, horned lark, bobwhite, Cooper's hawk, and prairie falcon. Summer nesters include Swainson's hawk, blue-winged teal, and ruddy duck. The goshawk may be a rare winter resident. The goldeneyes and common merganser are other winter residents. Herpetofauna include snapping turtle, Great Plains toad, western hognose snake, and the western garter snake. Catfish species are typical in area waters.

Climate. Precipitation averages 16 to 21 in (400 to 530 mm). Temperature averages 50 to 57 °F (10 to 14 °C). The growing season lasts 140 to 185 days.

Surface Water Characteristics. There are many major rivers in this area, including North and South Platte, Republican, Arkansas, Smoky Hill, Saline, Arikaree, and North and South Fork of the Solomon. In most of the area, good quality ground water is available, but it is scarce where shale is near the surface.

Disturbance Regimes. Fire, insects, and disease are predominant disturbance regimes.

Land Use. Nearly all of this area is in farms and ranches; about 60 percent is cropland. This is a major dry farming area. Irrigation occurs along major rivers.

Cultural Ecology. Reserved

Compiled by Rocky Mountain Region.

Section 331D–Northwestern Glaciated Plains

Geomorphology. This Section includes level to gently rolling continental glacial till plains and rolling hills on the Missouri Plateau. Steep slopes border some of the larger rivers. Elevation ranges from 2,500 to 5,000 ft (763 to 1,525 m). This Section is within the Great Plains physiographic province.

Lithology and Stratigraphy. Glacial till is underlain by soft Cretaceous marine shale.

Soil Taxa. Soils include frigid Borolls, Ustochrepts, Natriborolls, and Orthents with some Fluvents along the rivers. These soils are generally deep and range in texture from loamy to clayey.

Potential Natural Vegetation. Küchler mapped vegetation as grama-needlegrass-wheatgrass. Common species include blue grama, bluebunch wheatgrass, green needlegrass, needleandthread, western wheatgrass, and basin wildrye.

Fauna. Birds are typically grassland associated species or those associated with prairie potholes. These include the ferruginous hawk, Swainson's hawk, golden eagle, sharp-tailed grouse and sage grouse, mountain plover, clay-colored sparrow, and dabbling ducks. Riparian areas also provide for some woodland species at the edge of their ranges such as eastern screech-owl, red-headed woodpecker, and ovenbird. Other species which nearly reach the edge of their ranges in this Section are Sprague's pipit and Baird's sparrow. Typical herbivores and carnivores include white-tailed deer, mule deer, pronghorn, bobcat, and cougar. Smaller common herbivores include the white-tailed jackrabbit, white-tailed prairie dog, and black-tailed prairie dog. Less common species associated with this Section includes black-tailed jackrabbit, swift fox, dwarf shrew, and Canadian toad. The black-footed ferret and bison are species which historically occurred here. Herpetofauna typical of this Section are the snapping turtle, spiny softshell turtle, smooth green snake, and the prairie rattlesnake.

Climate. Precipitation averages 10 to 15 in (250 to 380 mm), with maximum occurring in spring and early summer. Winters are extremely cold with desiccating winds and snow. Climate is cold continental, with dry winters and warm summers. Temperature averages 37 to 45 °F (3 to 7 °C). The growing season lasts 100 to 130 days.

Surface Water Characteristics. There are high density dendritic drainage patterns on areas of exposed marine shales. Low to medium density drainage patterns occur on the better drained glacial till. The higher order streams show subtle structural and glacial influence. Major rivers include the Milk and the Poplar.

Disturbance Regimes. Fire and drought are the principal sources of natural disturbance.

Land Use. Most of the area is in crop land or is grazed by livestock.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Section 331E–Northern Glaciated Plains

Geomorphology. This area includes gently undulating to rolling continental glacial till plains with areas of kettle holes, kames, and moraines. Slopes adjacent to major stream valleys are steep. Elevation ranges from 2,000 to 6,000 ft (610 to 1,830 m). This Section is within the Great Plains physiographic province.

Lithology and Stratigraphy. Glacial till is underlain by soft Cretaceous and Lower Tertiary non-marine sedimentary rocks.

Soil Taxa. Soils include predominantly frigid Borolls. These soils are generally deep and have loamy textures.

Potential Natural Vegetation. Küchler mapped vegetation as wheatgrass-needlegrass. The natural prairie vegetation is characterized by western wheatgrass, needleandthread, green needlegrass, and blue grama. Little bluestem occurs on sloping and thin soils. Prairie cordgrass, northern reedgrass, and slim sedge occur on wet soils. Western snowberry and prairie rose are common shrubs.

Fauna. Birds are very similar to those that occur in Section 332A, but include some species associated with the Missouri River (Missouri Coteau region). These species are typical of riparian habitat, or typical of both prairie potholes and badlands. Several species follow the Missouri River upstream to near the western extent of their ranges; these include piping plover, least tern, chimney swift, eastern phoebe, purple martin, eastern bluebird, black-and-white warbler, ovenbird, indigo bunting, rose-breasted grosbeak, orchard oriole, and field and swamp sparrows. Western species reaching the edge of their range include lazuli bunting and black-headed grosbeak. Typical herbivores and carnivores include white-tailed deer, mule deer, pronghorn, and bobcat. Smaller common herbivores include the white-tailed jackrabbit, white-tailed prairie dog, and black-tailed prairie dog. Less common species associated with this Section includes black-tailed jackrabbit, swift fox, dwarf shrew, and hispid pocket mouse. The black-footed ferret and bison are species which are historically associated with this Section. Herpetofauna typical of this Section are the snapping turtle, spiny softshell turtle, smooth green snake, and the prairie rattlesnake.

Climate. Precipitation ranges from 10 to 20 in (250 to 510 mm) with more than half falling during the growing season. Winters are extremely cold with desiccating winds; precipitation is snow. Climate is cold continental, with warm, dry summers. Temperature averages 37 to 45 °F (3 to 7 °C). The growing season lasts 110 to 135 days.

Surface Water Characteristics. Low to medium density dendritic drainage patterns change to complex, high density dendritic patterns where the sedimentary rocks are exposed due to erosion of badlands.

Disturbance Regimes. Fire and drought are the principal natural sources of disturbance.

Land Use. Dryland farming and livestock grazing occur on most of the area.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Section 331F–Northwestern Great Plains

Geomorphology. This area includes gently sloping to rolling, moderately dissected shale plains. There are some steep, flat-topped buttes, particularly in eastern Wyoming. Badlands with eroded escarpments are in North Dakota and western South Dakota. Elevation ranges from 1,500 to 3,900 ft (458 to 1,200 m). This Section occurs on the Missouri Plateau and High Plains within the Great Plains physiographic province.

Lithology and Stratigraphy. This Section has soft Cretaceous and Lower Tertiary non-marine sedimentary rocks.

Soil Taxa. Soils include mesic and frigid Borolls and Ustolls, particularly in the northern, southern, and eastern parts of the Section. These soils are generally moderately deep to deep and have loamy to clayey textures. Argids, Orthents, and Orthids also occur, mostly in the central and western parts of the Section and on the badlands. These soils range from shallow to deep and generally have clayey textures.

Potential Natural Vegetation. Küchler mapped vegetation as wheatgrass-needlegrass. Most of the Section has natural prairie vegetation, which includes western wheatgrass, green needlegrass, blue grama, needleandthread, and buffalograss. Bluebunch wheatgrass, little bluestem, and sideoats grama occur on shallow soils. Common shrubs in draws and along streams include buffaloberry, chokecherry, snowberry, and sagebrush. Ponderosa pine, juniper, and some aspen occur in North Dakota and on the Pine Ridge in South Dakota.

Fauna. Birds are dry grassland and badland species, and riparian associates. Typical species are ferruginous hawk, golden eagle, sharp-tailed grouse and sage grouse, gray partridge, mourning dove, black-billed magpie, horned lark, western meadowlark, lark bunting, grasshopper sparrow, and chestnut-collared longspur. Riparian or wetland associated species include dabbling duck, eastern kingbird, blue jay, brown thrasher, and yellow warbler. Species near the edge of their range include chimney swift; eastern, western and mountain bluebirds; dickcissel; field sparrow; and orchard oriole. Typical herbivores and carnivores include white-tailed deer, mule deer, pronghorn, and bobcat. Smaller common herbivores include the white-tailed jackrabbit, white-tailed prairie dog, and black-tailed prairie dog. Less common species associated with this Section includes bighorn sheep and the black-

tailed jackrabbit. Rare species includes the black-footed ferret. Bison are historically associated with this Section. Herpetofauna typical of this Section are the snapping turtle, spiny softshell turtle, smooth green snake, and prairie rattlesnake.

Climate. Precipitation ranges from 10 to 20 in (250 to 510 mm), with more than half falling during the growing season. Winters are extremely cold with desiccating winds. Precipitation is snow. Climate is cold continental. Temperature averages 37 to 48 °F (3 to 9 °C). The growing season lasts 110 to 160 days.

Surface Water Characteristics. There are long, structurally controlled second and third order streams with low gradient, which are fed by high density, dendritic first order tributaries. Alternating hard and soft layers at low angles produce a complex pattern of resistant layers, temporary base levels, and headward and sideward erosion by undercutting. Ground water is scarce over most of the area but does occur locally in sand and gravel deposits. Major rivers include the Missouri, Cheyenne, Little Missouri, and Niobrara.

Disturbance Regimes. Fire and drought are the principal natural sources of disturbance.

Land Use. Dryland farming and livestock grazing occur on about 85 percent of the area. Some commercial timber harvests also occur.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Section 331G—Powder River Basin

Geomorphology. This area includes gently rolling to steep dissected plains on the Missouri Plateau. Wide belts of steeply sloping badlands border a few of the larger river valleys. In places, flat-topped, steep-sided buttes rise sharply above the surrounding plains. Elevation ranges from 3,000 to 6,000 ft (915 to 1,830 m). This Section is within the Great Plains physiographic province.

Lithology and Stratigraphy. There are Cretaceous and Lower Tertiary non-marine sedimentary rocks. Glacial lake beds also occur.

Soil Taxa. Soils include Orthents, Orthids, Argids, Borolls, and Fluvents. Temperature regimes are generally frigid in the north and mesic in the south. These soils are mostly medium to fine textured and range from shallow to deep.

Potential Natural Vegetation. Küchler mapped vegetation as grama-needlegrass-wheatgrass. About 20 percent of the area supports eastern ponderosa forest. Dominant grassland species include western wheatgrass, blue grama, green needlegrass, bluebunch wheatgrass,

and needleandthread. Little bluestem replaces bluebunch wheatgrass in the eastern part of the Section. Basin wild rye and sagebrush occur along streams and on bottomlands.

Fauna. Typical birds are sagebrush obligates or specialists, such as sage grouse, sage thrasher, and sage and Brewer's sparrows; sage thrasher and sage sparrow near the edge of their ranges in this Section. Other specialists are ferruginous and Swainson's hawks, golden eagle, Say's phoebe, and McCown's longspur. Typical riparian species include Lewis' woodpecker, yellow warbler, and lazuli buntings. Several bird species that reach or nearly reach the extent of their ranges in this Section are eastern screech-owl, red-headed woodpecker, Cassin's kingbird, pinyon jay, green-tailed towhee, and clay-colored sparrow. Typical herbivores and carnivores include white-tailed deer, mule deer, pronghorn, bobcat, and cougar. Smaller common herbivores include the white-tailed jackrabbit, white-tailed prairie dog, and black-tailed prairie dog. Less common is the black-tailed jackrabbit. The black-footed ferret is a rare species within this Section. Bison are historically associated with this Section. Herpetofauna typical of this Section are the Great Plains toad, snapping turtle, spiny softshell turtle, smooth green snake and prairie rattlesnake.

Climate. Precipitation ranges from 10 to 20 in (250 to 510 mm), most of which falls as spring and summer rain. Winter precipitation is snow. Climate is cold continental with dry winters and warm summers. Temperature averages 39 to 45 °F (4 to 7 °C). The growing season lasts 120 to 140 days.

Surface Water Characteristics. Low to medium density drainages occur on more permeable surfaces. Large, shallow head basins underlain by coal or scoria are water collection areas. Much of the drainage pattern is structurally controlled. Major rivers include the Yellowstone, Tongue, and Powder.

Disturbance Regimes. Fire and drought are the principal natural sources of disturbance.

Land Use. Livestock grazing is the dominant land use; a small amount of dryland farming also occurs.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Section 331H—Central High Plains

Geomorphology. This Section includes undulating to rolling plains, moderately dissected by streams. There are steep slopes, large streams, and isolated mesas, with rolling to hilly sand dunes that border some valleys. Local relief ranges up to tens of meters. Elevation ranges from 3,610 to 5,905 ft (1,100 to 1,800 m). This Section is in Fenneman and Johnson's Great Plains geomorphic physical division.

Lithology and Stratigraphy. Parts of the Section in southwestern Nebraska, southeastern Wyoming, and extreme northeastern Colorado is Tertiary ashly claystones and sandstones, with local conglomerates. Part of the extreme northeastern part of Colorado is also windblown dune sand, silt, and loess. The western part and southeast extension of the Section is Cretaceous shales, sandstones, siltstones, and local coals, with some calcareous shales and limestones in the extreme southeast. The extreme northwest part of the Section is a thin band of Pennsylvanian through Cretaceous sandstones, siltstones, shales, and some conglomerates. The extreme southwestern is Tertiary arkosic sandstones and conglomerates.

Soil Taxa. There are mesic temperature and ustic moisture regimes. Soils include Mollisols, Entisols, and Alfisols.

Potential Natural Vegetation. Predominant vegetation is short and mid grass prairie. Küchler classified potential vegetation as grama-buffalo grass prairie and sandsage-bluestem prairie, with northern floodplain forest along major drainages.

Fauna. Bison and wolves are historically associated with this Section. Current herbivores are white-tailed deer, mule deer, pronghorn antelope, prairie dog, jackrabbit, and cottontail. Red fox, bobcat, and coyote are the chief mammalian predators. Typical year-round bird species include horned lark, burrowing owl, prairie falcon, and kestrel. Summer nesters include Swainson's hawk, western and eared grebes, ruddy duck, and the western range of the red-headed woodpecker. Winter residents include northern shrike, golden-crowned kinglet, and goldeneye duck. Typical herpetofauna include hognose snake, prairie rattlesnake, Great Plains toad, snapping turtle, and painted turtle. Catfish species exist in rivers and lakes.

Climate. Precipitation averages 13 to 17 in (320 to 420 mm). Temperature averages 45 to 50 °F (7 to 10 °C). The growing season lasts 120 to 160 days (180 days in extreme south).

Surface Water Characteristics. The North and South Platte Rivers and their tributaries flow through here. Ground water is scarce and of poor quality where shale bedrock is near the surface. In much of the area, sand and gravel yield adequate amounts of ground water.

Disturbance Regimes. Fire, insects, and disease are predominant natural disturbances.

Land Use. Most of the area is in farms and ranches; there is some urban use on the western edge. About 60 percent of the area is rangeland grazed by cattle and sheep. About 25 percent of the area is in dry crops. An extensive amount of acreage is irrigated, water is usually obtained from rivers.

Cultural Ecology. Reserved.

Compiled by Rocky Mountain Region.

Section 331I-Arkansas Tablelands

Geomorphology. This Section includes undulating to rolling plains composed of shale that are moderately dissected by streams. In many places the shale is mantled by loess, alluvium, and outwash. Large stream valleys and isolated mesas with steep slopes and rolling to hilly dunes border some of the valleys. Local relief ranges from 10 to 300 ft (3 to 90 m). Elevation ranges from 3,610 to 6,235 ft (1,100 to 1,900 m). This Section is in Fenneman and Johnson's Great Plains geomorphic physical division.

Lithology and Stratigraphy. The north-central one-third of the Section is predominantly Quaternary eolian deposits, including windblown dune sand, silt, and loess, and local gravels and alluvium. The extreme northwest is Tertiary arkosic sandstones and conglomerates, with local ashly claystones and sandstones. Extreme southeast is Tertiary that is loose to well-cemented sand and gravel. The remainder of the Section (generally southern two-thirds) is Permian through Cretaceous sandstones, locally conglomeratic, and siltstones and shales, with local limestones. Western part of the southern 2/3 of the Section has more calcareous shales and limestones. A small area in the extreme south is Tertiary basalt flows and associated tuffs, breccias, and conglomerates.



Arkansas Tablelands Section.

Soil Taxa. There are mesic temperature and ustic moisture regimes. Soils include Mollisols, Entisols, and Alfisols.

Potential Natural Vegetation. Predominant vegetation consists of short and mid grass prairie, and some woodlands. Küchler classified vegetation as grama-buffalo grass prairie, sandsage-bluestem prairie, and juniper-pinyon woodland.

Fauna. Buffalo and wolves are historic residents of this Section. Large mammals include white-tailed deer, mule deer, and pronghorn antelope. Elk, black bear, and mountain lion occasionally come into the Section from the west. Horned lark, northern harrier, prairie falcon,

and burrowing owl are year-round residents; the northern range of the roadrunner extends to this Section. Summer nesters include Swainson's hawk, western and eared grebes, and ruddy duck. Winter residents include marlin, northern shrike, Brewer's blackbird, and cedar waxwing. Typical herpetofauna include the prairie rattlesnake, gopher snake, snapping turtle, and Great Plains toad. Catfish species are present in rivers and lakes.

Climate. Precipitation averages 10 to 17 in (250 to 430 mm). Temperature averages 45 to 50 °F (7 to 10 °C). The growing season lasts 120 to 180 days.

Surface Water Characteristics. Ground water is associated with sand and gravel over much of the area, but is scarce where shale bedrock is near the surface. The Arkansas, Chuchara, Purgatoire, Apishipa, and St. Charles Rivers flow through here. Local wells exist.

Disturbance Regimes. Fire, drought, insects, and disease have been the principal historical source of disturbance.

Land Use. Almost all of the area is in farms and ranches, but urban areas do occur along the western edge

near Denver and other cities. About 68 percent of the area is used for grazing purposes. About 8 percent of the area is irrigated, and about 15 percent of the area is in dry crops.

Cultural Ecology. Reserved.

Compiled by Rocky Mountain Region.

Section 331J—Northern Rio Grande Basin

Geomorphology. This area is in the Southern Rocky Mountain Province. This Section is located in north-central New Mexico and south-central Colorado. Landforms include valley, lowland, and elevated plains and hills. Elevation ranges from 6,875 to 8,800 ft (2,100 to 2,680 m). The major landform features are The San Luis Valley and the Rio Grande River.

Lithology and Stratigraphy. There are mostly Cenozoic sedimentary rocks and a few tertiary volcanic rocks. Included also are terrestrial basin fill of late Tertiary and Quaternary age.



Upper Rio Grande Basin.

Soil Taxa. Soils include Inceptisols, Alfisols, Entisols, Aridisols, and Mollisols. Temperature regimes range from mesic to frigid. Moisture regimes range from ustic to aridic.

Potential Natural Vegetation. Grama, galleta and sand dropseed grasses and Great Basin big sagebrush are found in ustic soil moisture regimes and cottonwood and willow along riparian corridors. Fescue-mountain muhly prairie also occurs. Küchler mapped potential vegetation as saltbush-greasewood and wheatgrass-needlegrass.

Fauna. This Section was once characterized by bison and large carnivores such as the gray wolf and grizzly bear. These species have been reduced, primarily at the hand of man, yet occasionally are still reported in the area. Currently, large ungulates include Rocky Mountain elk, mule deer, bighorn sheep, antelope, and moose; cougar, black bear, and coyotes comprise the large predator component throughout the Section. Historical and present-day herpetofauna include the Wyoming and western toads; spotted and northern leopard frogs; tiger salamander; short-horned and sagebrush lizards; the gopher snake, rubber boa, racer, and several species of garter. Habitats in this Section support a rich and diverse avifauna: neotropical migratory landbirds; waterfowl, including trumpeter swans and common loons; raptors, including bald and golden eagles and peregrine falcons; and gallinaceous species. The Colorado River cutthroat trout represents the historic salmonid component. Other fish that now inhabit the waters within this Section include: the rainbow, brown, brook, golden, mackinaw, and hybrid trout, plus arctic grayling; Rocky Mountain whitefish; speckled dace; squawfish; and others. Of special note is the Kendall Warm Springs dace, found only in this Section and only in one stream.

Climate. Precipitation ranges from 6 to 20 in (150 to 500 mm) annually with less than half of the precipitation falling during the winter. Temperature averages 39 to 57°F (4 to 14°C) and winters are generally cold. The growing season lasts 100 to 140 days

Surface Water Characteristics. There is limited precipitation; irrigation water is provided by the Rio Grande River and small reservoirs supported by run off

from nearby mountains. Wells can tap ground water in deep soils in valley plains. The Chama River is an important water source in the south part of this Section. The Conejos River flows through here.

Disturbance Regimes. Soil salinity is a problem in much of the area. Land Use. Much of this Section is in farms and ranches. About 25 percent of this area is irrigated cropland. Grazing and recreation are important activities.

Land Use. The Great Sand Dunes National Monument is located in this Section. About 50 percent of the area is Federally owned and about 50 percent is in farms and ranches. About 25 percent of the area is irrigated. Some grazing on native rangeland occurs.

Cultural Ecology. Humans have inhabited and made use of the Upper Rio Grande Basin for perhaps the past 12,000 or 13,000 years. For almost all of that time, people were hunters and gathers. Virtually every one of the various ecological zones within the basin was known and used in the battle for survival. This quest mandated a non-sedentary existence and did not allow for substantial groupings of people to cluster together for more than relatively short periods of time. Sometime between 1,000 and 2,000 years ago, people began to master the techniques of being successful agriculturalists. This resulted in significant lifestyle changes. Only portions of the basin were suitable for habitation: those where the elevation was low enough and the latitude southerly enough to provide growing seasons of sufficient length. This same agricultural lifestyle allowed for people to gather into sedentary groups and led to the rise of full-blown civilization.

In the last few hundred years, Euro-Americans have come to join native Americans in the Rio Grande Basin. With them they brought new ideas of land use. Once again, all of the basin's ecological zones are utilized. shepherds graze their sheep in the high country and miners extract minerals—even above timberline. Contemporary cultural components include Anglo, Hispanic, and Puebloan (Taos). Tourism and recreation are major contributors to today's economy, along with ranching and mining.

Compiled by Southwestern Region and Rocky Mountain Region.

Province 332–Great Plains Steppe

Five Sections have been delineated in this Province: 332A–Northeastern Glaciated Plains; 332B–Western Glaciated Plains; 332C–Nebraska Sand Hills; 332D–North-Central Great Plains; and 332E–South-Central Great Plains. These Sections are located in the north-central conterminous States, including parts of Oklahoma, Kansas, Nebraska, and South and North Dakota. The area of these Sections is about 134,000 mi² (347,100 km²).

Section 332A–Northeastern Glaciated Plains

Geomorphology. This is an area of nearly level to undulating continental glacial till and glacial lake plains, with areas of kettle holes, kames, and moraines. Some steep slopes occur adjacent to streams. Elevation ranges from 700 to 2,300 ft (214 to 704 m). This Section is within the Central Lowlands physiographic province.

Lithology and Stratigraphy. Glacial till is underlain by Cretaceous marine sedimentary rocks.

Soil Taxa. Soils include frigid Borolls with poorly drained Aquolls in depressional areas. These soils are generally deep, and textures range from sandy to clayey.

Potential Natural Vegetation. Küchler mapped vegetation as wheatgrass-bluestem-needlegrass. The natural prairie vegetation is dominantly western wheatgrass, needleandthread, green needlegrass, and blue grama. Little bluestem is important on sloping and thin soils. Northern reedgrass, prairie cordgrass, big bluestem, and slim sedge are important species on wet soils.

Fauna. Birds are typical prairie pothole inhabitants. This area is the most productive waterfowl breeding area in the country, especially for gadwall, mallard, pintail, blue-winged teal, and several diving ducks. Other typical pothole associated species are sandhill crane, northern harrier, piping plover, Wilson's phalarope, Franklin's gull, and marsh wren. The prairie surrounding the potholes provides habitat for a number of species: Swainson's hawk; sharp-tailed grouse; upland sandpiper; horned lark; Sprague's pipit; lark bunting; savanna, Baird's, LeConte's, and clay-colored sparrows; and chestnut-collared longspur. Rare species include least tern and bald eagle. Typical herbivores and carnivores include white-tailed deer, mule deer, and bobcat. Smaller herbivores which are common include the white-tailed jackrabbit, white-tailed prairie dog, and black-tailed prairie dog. Less common is the black-tail jackrabbit. Bison are historically associated with this Section. Typical herpetofauna are the Great Plains toad, snapping turtle, spiny softshell turtle, smooth green snake, and prairie rattlesnake.

Climate. Precipitation averages 15 to 20 in (380 to 510 mm) with more than half falling during the growing season. Winter precipitation is snow. Climate is cold continental with warm summers. Temperature averages 36 to 45 °F (2 to 7 °C). The growing season lasts 100 to 140 days.

Surface Water Characteristics. There are somewhat chaotic internal drainage patterns, with many glacial pothole lakes and ponds. Lake plains have some long, lineal drainages fed by high density dendritic drainages.

Disturbance Regimes. Fire and drought are the principal natural sources of disturbance.

Land Use. Dryland farming occurs on about 80 percent of the area.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Section 332B–Western Glaciated Plains

Geomorphology. Nearly level to undulating continental glacial till plains occur, with areas of kettle holes, kames, moraines, and glacial lake plains. Glacial lake plains and some steep slopes are adjacent to streams. Elevation ranges from 1,000 to 2,000 ft (305 to 610 m). This Section is within the Central Lowland physiographic province.

Lithology and Stratigraphy. Glacial till is underlain by Cretaceous marine sedimentary rock.

Soil Taxa. Soils include mesic and frigid Borolls and Ustolls, with poorly drained Aquolls in depressional areas. These soils are generally deep and range in texture from sandy to clayey.

Potential Natural Vegetation. Küchler mapped vegetation as wheatgrass-bluestem-needlegrass. The natural prairie vegetation is mainly western wheatgrass, needleandthread, green needlegrass, and blue grama. Little bluestem is important on sloping and thin soils. Northern reedgrass, prairie cordgrass, big bluestem, and slim sedge are important species on wet soils. Northern flood plain forest occurs along major drainages.

Fauna. This Section is an important migration corridor for most species of waterfowl, but especially for American coots, snow goose, mallard, and blue-winged teal. Potholes or associated wetlands provide breeding habitat for many of these species and others, such as grebe and black-crowned night-heron. Where non-grassland

habitat occurs, many birds associated with eastern avifauna nearly reach their westernmost extent; these include broad-winged hawk, ruby-throated hummingbird, Philadelphia vireo, cardinal, rose-breasted grosbeak, and rusty blackbird. Other typical species include greater prairie chicken, great crested flycatcher, eastern phoebe, blue jay, brown thrasher, dickcissel, and orchard oriole. Typical herbivores and carnivores include white-tailed deer, mule deer, and bobcat. Smaller common herbivores are the white-tailed jackrabbit, white-tailed prairie dog, and black-tailed prairie dog. Less common is the black-tailed jackrabbit. Bison are historically associated with this Section. Representative herpetofauna are the Great Plains toad, snapping turtle, spiny softshell turtle, smooth green snake, and prairie rattlesnake.

Climate. Precipitation ranges from 14 to 24 in (350 to 610 mm), with more than half falling during the growing season. Winter precipitation is mostly snow. Climate is cold continental with hot, humid summers. Temperature averages 39 to 43 °F (4 to 9 °C). The growing season lasts 110 to 155 days.

Surface Water Characteristics. The Missouri river is the major drainage. Few widely spaced perennial streams occur; there are some ponds and reservoirs. Sandstones yield high quantities of mineralized artesian water, while shales yield very little water.

Disturbance Regimes. Fire and drought are the principal natural sources of disturbance.

Land Use. Dryland farming occurs on about 65 percent of the area; the rest is grazed by livestock. A small amount of the area is irrigated.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Section 332C—Nebraska Sandhills

Geomorphology. This area has rolling to steep, irregular sand dunes stabilized by vegetation, with narrow, elongated, gently rolling sloping valleys between dunes. Elevation ranges from 1,970 to 3,950 ft (600 to 1,200 m). This Section is within Fenneman and Johnson's Great Plains geomorphic physical division.

Lithology and Stratigraphy. This Section is composed of Tertiary sandstones, conglomerates, and minor shales; with Quaternary windblown dune sand and loess covering the Tertiary sandstones and conglomerates throughout much of the area.

Soil Taxa. Soils include mesic Psamments.



Landforms and vegetation characteristic of the Nebraska Sandhills Section in the Nebraska National Forest.

Potential Natural Vegetation. Mid and tall grass plant communities are present including Nebraska sandhills prairie (bluestem, sandreed). Küchler classified vegetation as sandhills prairie, wheatgrass-bluestem-needlegrass, and, along major drainages, northern flood plain forest.

Fauna. Bison and wolves are historically associated with this section. Current large mammals include white-tailed deer, and mule deer and pronghorn antelope, for which this is the eastern range. Smaller mammals typical of the area are jackrabbit, cottontail, prairie dog, bobcat, and red fox. Typical year-round avifauna include bobwhite, greater prairie chicken, and mallard. Kestrel, eastern bluebird, swallow, and belted kingfisher are summer nesters. The northern extent of the sharp-shinned hawk's winter range lies in the Section, and the goldeneye duck is a winter resident. Typical herpetofauna are the snapping turtle, painted turtle, Great Plains toad, plains hognose snake, and bull snake. Catfish are common in rivers and ponds.

Climate. Precipitation ranges from 17 to 23 in (430 to 580 mm). Temperature averages 48 to 52 °F (9 to 11 °C). The growing season lasts 140 to 150 days.

Surface Water Characteristics. There are many small lakes and ponds and a few streams. Ground water is abundant and of good quality. The Niobrara, North and Middle Loup, Snake, Dismal, Elkhorn, Calamus, and Cedar Rivers flow through here.

Disturbance Regimes. Fire, insect and disease are predominant natural disturbances.

Land Use. Nearly all of this area is in large ranches, most of which are grazed. Use of sprinkler irrigation has increased over recent years.

Cultural Ecology. Reserved.

Compiled by Rocky Mountain Region.

Section 332D–North-Central Great Plains

Geomorphology. There are nearly level to gently rolling till plains with potholes and well defined dendritic drainage system. Moderate to steep slopes are adjacent to major valleys. River and creek valleys have smooth floors and steep walls. Higher parts of tablelands are moderately sloping, but steeper areas occur on ridges and drainage ways. Drainages are well defined except in some undulating areas where eolian materials cover the bedrock. Elevation ranges from 1,310 to 2,950 ft (400 to 900 m). This Section is within Fenneman and Johnson's Great Plains geomorphic physical division.

Lithology and Stratigraphy. Most of the Section is Cretaceous marine shale, with local Tertiary sandstones and claystones in the extreme south.

Soil Taxa. Mesic temperature and ustic moisture regimes occur. Soils include Mollisols, including Agriborolls and Haplustolls.



Ft. Pierce National Grassland in the North-Central Great Plains Section of central South Dakota.

Potential Natural Vegetation. Kuchler mapped potential vegetation as wheatgrass-needlegrass prairie and wheatgrass-bluestem-needlegrass prairie and wheatgrass-bluestem-needlegrass prairie with northern flood plain forests along the Missouri River lowlands. Other communities consist of mixed and natural prairie.

Fauna. Bison are historically associated with this Section, and black-footed ferrets are former inhabitants. White-tailed deer and a smaller population of mule deer are current herbivores. Small herbivores include the jackrabbit and prairie dog. Bobcat, red fox, and swift fox are present. Prairie potholes are important habitat for many species of migrating waterfowl. Horned lark, bobwhite, and greater prairie chicken are year-round residents. Summer residents include burrowing owl and belted kingfisher in riparian zones. Dark-eyed junco and pine siskin are winter residents. Typical herpetofauna include the Great Plains toad, snapping turtle, painted turtle, and prairie rattlesnake. Black crappie and catfish are common fish species.

Climate. Precipitation averages 15 to 24 in (370 to 600 mm). Temperature averages 45 to 50 °F (7 to 10 °C). The growing season lasts 130 to 160 days.

Surface Water Characteristics. The Missouri, Niobrara, and White Rivers flow through here. There is a limited supply of ground water available. Shallow water developments exist, such as dug ponds and small reservoirs. Some deep artesian wells exist. Reservoirs occur on the Missouri river.

Disturbance Regimes. Fire, insects, and disease are the primary natural disturbances.

Land Use. Most of the area is in farms or ranches, with limited urban expansion. About 50 percent of the area is in dry crops. Grazing is common, especially on the Dakota-Nebraska Tableland. Irrigation occurs along the Missouri River.

Cultural Ecology. Reserved.

Compiled by Rocky Mountain Region.

Section 332E—South-Central Great Plains

Geomorphology Gently sloping loess-mantled narrow ridgetops are separated by steep slopes bordering drainage ways. Some stream valleys with nearly level flood plains and large stream terraces exist. Dissected plains with broad rolling ridgetops and moderately steep valley sides occur. Valleys are usually narrow with broad flood plains and terraces, and hilly dissected plains. There are rivers with wide flood plains and terraces, and small streams with narrow bottomlands. Rolling plains have a deep mantle of windblown sand and sandy outwash. Elevation ranges from 1,310 to 2,950 ft (400 to 900 m). This

Section is within Fenneman and Johnson's Great Plains geomorphic physical division.

Lithology and Stratigraphy. Most of Section is Cretaceous marine shales, with some sandstones in the extreme northwest. Quaternary windblown dune sands and loess often cover the Cretaceous shales.

Soil Taxa. There are mesic and thermic temperature and ustic moisture regimes. Soils include Mollisols and Alfisols.

Potential Natural Vegetation. Predominant vegetation is grass and prairie communities. Kuchler mapped vegetation as bluestem-grama prairie, sand sage-bluestem prairie, northern flood plain forests, and buffalograss.

Fauna. Bison, wolves, and black-footed ferrets are historically associated with this Section. Present large mammals include white-tailed deer, mule deer, and a small population of pronghorn antelope. Typical small mammals include bobcat, red fox, jackrabbit, cottontail, and prairie dog. Typical year-round avifauna include the introduced ring-necked pheasant, horned lark, bobwhite, Cooper's hawk, and prairie falcon. Summer nesters include Swainson's hawk, blue-winged teal, and ruddy duck. The goshawk may be a rare winter resident. The goldeneye and common merganser are other winter residents. Herpetofauna include snapping turtle, Great Plains toad, western hognose snake, and the western garter snake. Catfish species are typical in area waters.

Climate. Precipitation ranges from 20 to 35 in. (500 to 900 mm). Temperature averages 50 to 61 °F (10 to 16 °C). The growing season lasts 150 to 230 days.

Surface Water Characteristics. Large rivers, streams, ponds, reservoirs, and wells exist in this Section. Ground water is abundant in areas associated with sand and gravel deposits; however, it is scarce and may be mineralized in areas where shale, sandstone, clay, and limestone are near the surface. Many rivers flow through this Section, including the Platte, Loup, Republican, Cimarron, Arkansas, Solomon, and Saline. Large reservoirs include Johnson, Harlan, Wilson, Wacanda, and Cheney.

Disturbance Regimes. Fire, insects, and disease are primary natural disturbances.

Land Use. Most of the Section is in farms and ranches. About 60 percent of the area is in crop land. About 35 percent of the area is grazed. Irrigation occurs along rivers in most of the area accounting for approximately 5 percent of the total area; however, in the central area, where corn is the major cash crop, it is irrigated extensively.

Cultural Ecology. Reserved.

Compiled by Rocky Mountain Region.

Province M331–Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

Nine Sections have been delineated in this Province: M331A–Yellowstone Highlands; M331B–Bighorn Mountains; M331D–Overthrust Mountains; M331E–Uinta Mountains; M331F–Southern Parks and Rocky Mountain Range; M331G–South-Central Highlands; M331H–Northern-Central Highlands and Rocky Mountain; M331I–Northern Parks and Ranges; and M331J–Wind River Mountain. These Sections are located in the west-central conterminous States, including parts of New Mexico, Colorado, Utah, Wyoming, Idaho, and Montana. The area of these Sections is about 35,000 mi² (68,000 km²). Section M331C is not delineated.

Section M331A–Yellowstone Highlands

Geomorphology. The Yellowstone Plateau was formed from two volcanic episodes. Other areas include high rugged mountains with ridges and cirques at higher

elevations and narrow to broad valleys. Much of this area has been glaciated, and moraines are common. Elevation ranges from 6,000 to 13,000 ft (1,800 to 4,100 m) in the mountains, and 2,500 to 6,500 ft (763 to 1,983 m) in the basins and valleys. This Section is within the Middle Rocky Mountains physiographic province.

Lithology and Stratigraphy. Precambrian metamorphic and Tertiary volcanic rocks are in this area. Main surface flows consist of silicic rhyolites and welded tuffs. Mafic basalts rim the edge of the plateaus.

Soil Taxa. There are frigid and cryic Ochrepts, Boralfs, and Borolls, with poorly drained Fluvents, Aquolls, and Aquepts in the basins and valleys. These soils are generally shallow to moderately deep, but can be deep in valley areas. Textures are usually medium to moderately coarse with abundant rock fragments.



Yellowstone Falls, Yellowstone National Park, Wyoming.

Potential Natural Vegetation. Küchler mapped potential vegetation as wheatgrass-needlegrass-shrubsteppe on drier, lower elevation valleys (55 percent), and Douglas-fir forest and western spruce-fir forest (45 percent) between 5,500 and 9,500 ft (1,667 and 2,879 m). Lodgepole pine is the common cover type, with an understory of grouse whortleberry, pine grass, heartleaf arnica, or Oregongrape. Alpine vegetation, including whitebark pine and subalpine fir, occurs above 9,500 ft (2,878 m). Sheep fescue, alpine bluegrass, and American bistort are common grass and forb species.

Fauna. Birds are typical of the forested portions of the northern Rocky Mountains, including Steller's jay, black-capped chickadee, and pine siskin. This Section boasts a very rich avifauna, including such specialists as white pelican, trumpeter swan, and (black) rosy finch. Other typical species include harlequin duck, Barrow's goldeneye, Swainson's hawk, bald eagle, osprey, sage grouse, sandhill crane, Franklin's gull, American dipper, Townsend's solitaire, yellow-rumped warbler, and Brewer's sparrow. Typical herbivores and carnivores include bison, mule deer, pronghorn, elk, moose, black bear, bobcat, and cougar. Smaller common herbivores include the snowshoe hare and the northern flying squirrel. Rare species include the grizzly bear, gray wolf, wolverine, fringed myotis, pygmy shrew, pygmy rabbit, Preble's shrew, and Uinta chipmunk. Herpetofauna typical of this section are the spotted frog, prairie rattlesnake, rubber boa, boreal toad, and bloched tiger salamander.

Climate. Precipitation ranges from 20 to 45 in (510 to 1,140 mm) annually; most occurs during fall, winter and spring. It occurs mostly as snow above 6,000 ft (1,800 m). Rain is common during the growing season. Climate is cold, moist continental. Temperature averages 35 to 47 °F (2 to 8 °C). The growing season lasts 25 to 120 days; it is less at some higher elevations.

Surface Water Characteristics. Many perennial streams and lakes occur. Ground water supplies are small and mostly untouched. Many lakes and wet meadows are associated with areas above 6,000 ft (1,800 m). Large lakes include Yellowstone Lake, Henry's Lake, Lewis Lake, Island Park Reservoir, and Shoshone Lake. Hot springs are fairly common. Glacial valleys dominate second and higher order streams. There are many short, steep tributaries with high water and sediment delivery efficiencies.

Disturbance Regimes. Historic fire occurrence has been low intensity, low severity, patchy fires and infrequent, high intensity, high severity, continuous fires.

Fire suppression has largely reversed this situation. Insect infestations and outbreaks of disease are also an important natural source of disturbance.

Land Use. Timber production and livestock grazing are the dominant land uses. A small amount of forage and other crops are grown in some valleys. The mountains are used for wildlife habitat, watershed, and recreation.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Section M331B-Bighorn Mountains

Geomorphology. There are high mountains with sharp crests, rolling uplands, and dissected hills, with alpine glaciation dominating the upper third of the area. The rugged hills and mountains are cut by many narrow valleys with steep gradients. Elevation ranges from 4,000 to 13,000 ft (1,220 to 3,962 m). This Section is within the Middle Rocky Mountains physiographic province.

Lithology and Stratigraphy. The central part of the Section is Precambrian quartz monzonite to quartz diorite in the north and Precambrian gneiss in the south. The periphery of the Section is Paleozoic carbonates and shales. A small area in the extreme northeast of the Section is Cretaceous sandstones, siltstones, and shales.

Soil Taxa. Soils include cryic Borolls, Ochrepts, and Boralfs. These soils are generally shallow to moderately deep, but some deep soils occur in alluvial and colluvial basins. Textures are generally loamy or sandy, with large amounts of rock fragments.

Potential Natural Vegetation. Küchler mapped potential vegetation as Douglas-fir forest and western spruce-fir forest (50 percent) and wheatgrass-needlegrass-shrubsteppe (50 percent). Common tree species include lodgepole pine, Douglas-fir, subalpine fir, and Engelmann spruce. Idaho fescue, bluebunch wheatgrass, and mountain big sagebrush are common grass and shrub species.

Fauna. Birds are typical of the Rocky Mountains. Species include ferruginous and Swainson's hawks, golden eagle, blue grouse, sage grouse, mountain plover, Steller's and gray jay, Clark's nutcracker, Townsend's solitaire, green-tailed towhee, and western tanager. Species nearing the edge of their ranges are calliope hummingbird, indigo bunting, and clay-colored sparrow. Typical herbivores and carnivores include white-tailed deer, mule deer, elk, moose, pronghorn, black bear, bobcat, and cougar. Smaller common herbivores include the snowshoe hare, yellow-bellied marmot, and the northern flying squirrel. Bison are historically associated with this Section. Herpetofauna typical of this Section are the spotted frog, rubber boa, boreal toad, bloched tiger salamander, and, at lower elevations, the prairie rattlesnake.

Climate. Precipitation ranges from 15 to 40 in (380 to 1,020 mm), with much occurring as spring and fall rains. Climate is cold continental with dry, cold winters. Temperature averages 36 to 43 °F (2 to 6 °C). The growing season lasts 45 to 90 days.

Surface Water Characteristics. This area has medium to fine density dendritic patterns with moderate gradients. Streams are deeply entrenched as they leave the mountains. Lakes occur in glaciated terrain, as well as in high elevation cirques and basins. Major streams include the Tongue, Shell, and Tensleep.

Disturbance Regimes. Fire, insects, and disease are the dominant natural sources of disturbance. Fire has historically been fairly frequent, low intensity, and patchy; however, fire suppression has caused this pattern to change to less frequent, more intense, larger fires.

Land Use. The land is used for timber harvest, livestock grazing, wildlife habitat, watershed, and recreation.

Cultural Ecology. Reserved.

Compiled by Northern Region and Rocky Mountain Region.



Bighorn Mountains, northern Wyoming.



Typical Bighorn Mountains landscape in the Bighorn National Forest.

Section M331D—Overthrust Mountain

Geomorphology. This Section occurs within the Middle Rocky Mountain physiographic province. The Overthrust Mountains Section is part of western Wyoming, southeastern Idaho, and north-central Utah. Mountain ranges include the Teton and Salt River Ranges in Wyoming; Snake River, Caribou, Webster, Aspen, Portneuf, Bannock, and Bear River Ranges in Idaho; and the Wasatch Range in Utah. Anticlinal and synclinal structures and thrust fault zones control development of linear valleys and ridges in the northern part of this Section. Some ranges are bound by thrust faults that dip west. Snake River Mountains are distinct, separate, and subparallel. They are mostly steep, rugged mountains with narrow to broad valleys. The Teton Range is the highest in this Section. The Wasatch Range has very steep topography and an extensive and active fault. Higher portions of this Section have been glaciated, with few active glaciers and snow fields in the Teton Range. Many cirques, moraines, and other glacial features are present and extend into Utah. Alluvial fans and mud flow fans have developed at the mouths of many canyons in Utah. Mass movements are common and helped form the Wyoming Range. Elevation ranges from 5,000 to 13,000 ft (1,524 to 3,962 m). Local relief ranges from 3,000 to 7,000 ft (900 to 2,134 m).

Lithology and Stratigraphy. There are Paleozoic and Mesozoic sedimentary rocks. Some Precambrian rock is exposed near Pocatello, Idaho. Sedimentary rocks such as limestones, siltstone, cherts, sandstones, and shales dominate this Section.

Soil Taxa. Soils include Alfisols, Mollisols, Histisols, Inceptisols, and Entisols, in combination with frigid and cryic soil temperature regimes, along with xeric, udic and aquic soil moisture regimes.

Potential Natural Vegetation. Küchler vegetation types include lodgepole pine-subalpine forest, and Douglas-fir forest with outer fringes of sagebrush steppe in the northern portion of the Section. Mountain mahogany-oak scrub surrounds a Douglas-fir forest in the Utah portion of the Section. The Soil Conservation Service identifies the potential natural vegetation as mixed conifers and sagebrush-grassland with Douglas-fir, lodgepole pine, and aspen occupying northern aspects. About 50 percent is Douglas-fir forest. Vegetation zones are controlled by a combination of altitude, latitude, slope exposure, and prevailing winds. Areas of alpine tundra exist on highest mountains, subalpine zone has spruce-fir forests, and montane zone has ponderosa pine and Douglas-fir forest. Sagebrush occurs at the lower elevations.



Star Valley, Wyoming.



The mountainous region of the Overthrust Mountains Section is illustrated by the Teton Mountain Range. These mountains are derived from sedimentary and Precambrian parent materials that have been thrust upward.

Fauna. This Section was once characterized by bison, bighorn sheep, and large carnivores such as the gray wolf and grizzly bear. These species have been reduced, primarily at the hand of man, to isolated areas within their historic range. Currently, large ungulates include Rocky Mountain elk, mule deer, and moose; cougar and black bear comprise the large predators. Historical and present-day herpetofauna include the western toad and Great Basin spadefoot; spotted and northern leopard frogs; tiger salamander; short-horned and sagebrush lizards; the gopher snake, rubber boa, racer, several species of garter, and the western rattlesnake. Habitats in this Section support a rich and diverse avifauna of neotropical migratory land birds, waterfowl and gallinaceous species. Three subspecies of inland cutthroat trout (Yellowstone, Bonneville, and Colorado) represent the historic salmonid component. In addition to the above cutthroat species, rainbow, brown, brook, and hybrid trout now inhabit most waters.

Climate. Precipitation ranges from 16 to 40 in (400 to 1,016 mm) annually; most occurs during fall, winter and spring. It occurs mostly as snow above 6,000 ft (1,820 m). The semiarid steppe regime is where precipitation falls mostly in the winter, with large amounts falling as snow. Climate is influenced by prevailing winds and the general north-south orientation of the mountain ranges. Summers are dry with low humidity. Precipitation during

the frost-free period is 30 to 40 percent of the evaporation potential. Temperature averages 35 to 45 °F (2 to 7 °C), but may be as high as 50 °F (10 °C) in the valleys. The growing season lasts 80 to 120 days.

Surface Water Characteristics. There is a low to moderate frequency of rapidly flowing rivers and streams. Rivers flow into the Great Basin or Snake River drainage. A small area of the Section is drained by the Colorado River. Few lakes and wet meadows are associated with areas higher than 5,000 ft (1,500 m). Large lakes include Bear Lake, Gray's Lake, Palisades Reservoir, and Blackfoot Reservoir.

Disturbance Regimes. After fire, aspen and lodgepole pine replace higher seral species. Mass movements are common and water erosion is occurring.

Land Use. Forest-related industries are important in this Section. Approximately 70 percent of the land is forested and used for timber production and livestock grazing. Mining and oil and gas extraction are also important uses; large reserves of phosphate are in southeast Idaho. Recreation remains very important.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.

Section M331E-Uinta Mountains

Geomorphology. This Section occurs within the Middle Rocky Mountain province. The Uinta Mountains Section is located in northeastern Utah and the southwest corner of Wyoming. Mountains are an anticlinal uplift with an east-west orientation. Periglacial and glacial processes have shaped higher elevation landforms with freezing and thawing, an active process. At lower elevations, erosion by water and wind are active landforming processes. Elevations range from approximately 6,000 to 13,000 ft (1,800 to 3,900 m). Slopes range from about 5 percent to vertical in gradient.

Lithology and Stratigraphy. Precambrian quartzite forms the core of the Uinta Mountains, with inclusions of red pine shale. At lower elevations, there is predominantly Mississippian and Madison limestone; inclusions of Bishop conglomerate, Brown's Park and other minor formations occur.

Soil Taxa. Entisols, Inceptisols, and Alfisols dominate the timbered land. Mollisols occur in the meadows, land vegetated with aspen, sagebrush and grass, and mountain brush sites. Temperature regimes range from mesic to pergelic, and soil moisture regimes are aridic, xeric, and udic.

Potential Natural Vegetation. K uchler vegetation types include alpine meadows, Douglas-fir forest, and western spruce-fir forest. It has been noted that some of K uchler's vegetation types are incorrect for this Section. More accurate information, from higher to lower elevations, is alpine tundra, Engelmann spruce, spruce-fir, lodgepole pine, subalpine meadow, Douglas-fir, ponderosa pine, aspen, mountain big sagebrush, oak and mountain brush, pinyon-juniper, Wyoming big sagebrush, and cold desert shrub. Douglas-fir is limited to limestone and lower elevations in canyons on quartzite. Oak communities are generally limited to the western portion of the Section. The eastern portion is mostly juniper-pinyon woodland with sagebrush steppe.

Fauna. Mammalian predators include cougar, black bear, coyote, bobcat, red fox, ringtail, and pine marten. Lynx and wolverine occurred historically; both may still occur in small numbers. Once common, bighorn sheep and elk populations were greatly reduced or extirpated in the early 1900's. Bighorn have been re-introduced in a few places, and elk now occur throughout the Section. The presence of Moose is also widespread. Mountain goats have been introduced, their numbers appear to be increasing. Pronghorn antelope are found at lower elevations. River otters were recently re-introduced to portions of the Green River. Small mammals of interest include pika and yuma myotis. Breeding raptors include red-tailed, Cooper's, sharp-shinned, Swainson's, marsh, and ferruginous hawks; kestrel; northern goshawk; flammulated, great horned, short-eared, long-eared, saw-whet, and boreal owls; golden eagle; and prairie falcon. Peregrine falcon and osprey nest along the Green River and Flaming Gorge. Bald eagle and rough-legged hawk

winter here. Great gray owls occurred historically, but may not be present today. Sandhill cranes may nest here; whooping cranes and common loons pass through during migration. White-tailed ptarmigan and pheasant have been introduced; blue, ruffed, and sage grouse are native gallinaceous species. Many neotropical migrant land birds breed here. The three-toed woodpecker is common in the Uinta Mountains. Bonneville and Colorado River cutthroat trout are important native species; introduced trout species are present in most lakes and streams. The Green and Yampa Rivers contain proposed critical habitat for four endangered fishes endemic to the Colorado River system Colorado squawfish, razorback sucker, humpback chub, and bonytail chub. Two candidate species, flannelmouth sucker and roundtail chub, also occur here.

Climate. Precipitation ranges from 8 to 35 in (200 to 890 mm) annually. Most precipitation comes in the winter in the form of snow above 9,000 ft. Summer afternoon storms are common in higher elevations. There is a high variability of precipitation at lower elevations; but, generally, summer and winter precipitation is about equal, with some years wet and others dry. Temperature ranges from 28 to 45  F (-4 to 8  C). The growing season lasts 20 to 90 days.

Surface Water Characteristics. There is a high frequency of rapidly flowing rivers and streams. Flows from the western portion of the Section are to the Provo River and into the Great Salt Lake. Rivers flow from north to south on the south slope, and from south to north on the north slope. Predominant flows on the south slope join flows from the west and continue south to join the Colorado River. Rivers are glaciated or stream cut, with numerous lakes and wet meadows associated with glaciated areas above 9,500 ft (2,880 m).

Disturbance Regimes. From low to high elevation, alpine fire is probably insignificant. Engelmann spruce has low frequency and small fires (frequency of 300 to 400 years or more and mostly less than 100 acres. In mixed conifers there are more frequent and larger fires than in the Engelmann spruce belt. Lodgepole pine has an 80 to 200 year interval and large fires to 20,000 acres or more. Ponderosa pine has 20 to 50 year interval underburns. Mountain big sagebrush and mountain brush have 20 to 80 year intervals and 10 to 1,000 acres or more in size. Pinyon-juniper has a 20 to 200 year interval with small fires up to 100 acres being common and larger fires being rare. These estimates of fire frequency and size are applicable to presettlement times. In modern times, the national forest fire suppression policy has resulted in reduced fire frequency and size in all timber types. Periodic flooding in the major stream systems occurs in spring with snow melt. Degree of flooding depends on high elevation and mid elevation melt levels and depth of snow. One hundred year and 50 year flooding events have caused extensive damage downstream.

Land Use. Much of the land is set aside for national parks, monuments, and primitive areas. Livestock grazing

and timber production are important uses, along with recreation and mining.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.

Section M331F—Southern Parks and Rocky Mountain Ranges

Geomorphology. Included in the Southern Rocky Mountain Province, this Section is located in northeast-central New Mexico and south-central Colorado. Landforms are mountains and a few valley plains. The Sangre de Cristo Mountains are this Section's major landform feature. Elevation ranges from 7,500 to 14,000 ft (2,300 to 4,300 m).

Lithology and Stratigraphy. There are Precambrian igneous and metamorphic rocks and Cenozoic and Paleozoic sedimentary rocks. A few Cretaceous through Mid-Tertiary intrusive volcanic and volcanoclastic rocks are present.

Soil Taxa. Soils include Glossoboralfs with frigid soil temperature regimes and udic soil moisture regimes, and Cryoboralfs and Cryochrepts with cryic soil temperature regimes and udic soil moisture regimes.

Potential Natural Vegetation. Predominant vegetation includes Douglas-fir and ponderosa pine in frigid soil

temperature regimes; Engelmann spruce and subalpine fir in cryic soil temperature regimes; and kobresia, geum and arenaria in alpine pergelic zones.

Fauna. Reserved.

Climate. Precipitation averages 24 to 28 in (600 to 700 mm) annually, with less than half of the precipitation falling during the winter. Temperature averages 32 to 45 °F (0 to 7 °C) and winters are cold. The growing season lasts 70 to 110 days.

Surface Water Characteristics. Water from streams and lakes is abundant and ground water is plentiful.

Disturbance Regimes. Fires vary in frequency and intensity in ponderosa pine stands, but may occur when fuel load is high and dry. Fire is rare in areas with cryic temperature regimes and udic soil moisture regimes. The upper mountain slopes are forested, but merchantable timber is scarce. Recreation, mining, and ranching are important land uses.

Land Use. Reserved.

Cultural Ecology. The Southern Parks and Rocky Mountain Ranges Section is comprised largely of high elevation and very high elevation meadows and mountain ranges, principally the Sangre de Cristo Mountains. High elevation parks and ranges present physical limitations



Valle Vidal, Carson National Forest, northern New Mexico.

with regard to weather patterns, reduced oxygen levels, lack of abundance and variety in plant and animal communities, and a short growing season. There is little evidence of permanent occupation during prehistoric times, but high elevation areas have been utilized on a relatively limited basis from the earliest dates of human occupation in the Southwest, i.e., since about 12,000 years ago. Although such areas are somewhat inhospitable, prehistoric peoples did make considerable use of various resources found in high elevation areas. These included lithic materials, large and small game, plant materials, spiritual power locations, and various minerals. With heavy reliance on agriculture beginning around 1000 A.D., early farmers began using the lower limits of high elevation areas to grow crops. High elevation areas have the most abundant and most reliable rainfall in the Southwest, which functioned to attract agricultural peoples; but limitations were presented by an increasingly shorter growing season with increase in elevation.

In the earlier portion of the historic period in the 1600's and 1700's high elevation activities included continued hunting and foraging by Native Americans, but with the addition of Anglo fur trapping and Hispanic summer sheep pasturage. As Anglo and Hispanic utilization increased, such activities as hard rock mining, cattle grazing, and timber harvest and freighting grew in importance. These activities were highly dependent on Eastern transportation and market systems. By the late 1800's, more and more farms, ranches, and homesteads made their appearance in the Sangre de Cristo Mountains. Through construction of irrigation systems, supplied with water from the relatively abundant precipitation at high elevations, farmers and homesteaders were able to survive by growing crops to help feed cattle and sheep herds during the harsh winter months. Farms, ranches, and homesteads were generally single-family operations, but a number of small towns, mostly populated by Hispanic peoples, began to spring up. Much of the area within this Section is now national forest land, with a significant portion designated as wilderness. Economic uses of the mountains include recreation, logging, and ranching. Both Hispanic and Native American communities continue many traditional uses of the mountains, and many of the peaks have special religious significance for nearby pueblos.

Compiled by Southwestern Region.

Section M331G—South-Central Highlands

Geomorphology. Steeply sloping to precipitous mountains are dissected by many narrow stream valleys with steep gradients. Upper mountain slopes and crests may be covered by snowfields and glaciers. High plateaus and steep walled canyons are common, especially in the west. Elevation ranges from 7,545 to 14,110 ft (2,300 to 4,300 m). This Section is within Fenneman and Johnson's Southern Rocky Mountains (eastern half of the Section) and Colorado Plateaus (western half of the Section) geomorphic physical divisions.

Lithology and Stratigraphy. The San Juan Mountains area (eastern half of the Section) is Tertiary volcanic ash flows, lavas, and conglomerates with local porphyritic intrusives. The western half is mostly Pennsylvanian through Cretaceous sandstones, siltstones, shales, and conglomerates, with local carbonates near the San Juan Mountains. In the extreme southern part of the Section is a small area of Tertiary sandstones, shales, and conglomerates.



South-Central Highlands Section.

Soil Taxa. This area has frigid, cryic and pergelic temperature regimes, and aridic, ustic, and udic moisture regimes. Mollisols, Alfisols, Inceptisols, and Entisols are most dominant on the uplands. Great groups and suborder combinations at the higher elevations would include Cryoborolls, Cryochrepts, Cryumbrepts, Cryoboralfs. Haploborolls, Argiborolls, Haplustalfs, and Eutroboralfs are dominant at lower elevations. Valley bottoms and riparian areas will have moist versions (aquic) of Mollisols and Entisols, and certain amounts of Histisols. Valley bottoms often contain Fluvaquents, Cryaquents, Cryaquolls, Haplaquolls, and Borohemists.

Potential Natural Vegetation. Vegetation ranges from shrub and grasslands, forests, and alpine tundra. Küchler classified vegetation as southwestern spruce-fir forest; pine-Douglas-fir forest; mountain mahogany-oak scrub; Great Basin sagebrush; juniper-pinyon woodland; and alpine meadows and barren.

Fauna. Elk, mule deer, black bear, and mountain lion are common large mammals of this Section. Rocky Mountain bighorn sheep inhabit higher elevations, and moose have been recently introduced. Smaller mammals include beaver, marmot, snowshoe hare, pine marten, and pika. Common forest-dwelling birds are Steller's jay, grey jay, and Clark's nutcracker, and blue grouse. Mountain bluebird, broad-tailed hummingbird, and Swainson's hawk are typical summer residents. Herpetofauna present

include western garter snake, chorus frog, and leopard frog. Native cutthroat trout have been displaced in parts of their former range by brook, rainbow, and brown trout.

Climate. Precipitation ranges from 15 to 30 in (370 to 750 mm). Temperature averages 32 to 45 °F (0 to 7 °C). The growing season last less than 70 days.

Surface Water Characteristics. Water from streams and lakes is abundant. Ground water is plentiful. The Rio Grande, Animas, Gunnison, and San Miguel Rivers flow through here.

Disturbance Regimes. Fire, insects, and disease are principal sources of natural disturbance.

Land Use. More than 50 percent of this area is Federally owned, the remainder is in farms, ranches, and private holdings. Most of the grassland and much of the open woodland is grazed. Some small valleys are irrigated. Recreation, mining, and timber harvest are important land uses.

Cultural Ecology. Reserved.

Compiled by Rocky Mountain Region.

Section M331H–North-Central Highlands and Rocky Mountain

Geomorphology. This area includes steeply sloping to precipitous flat-topped mountains dissected by narrow stream valleys with steep gradients. High plateaus have steep walled canyons. There are gently rolling mountain parks, mountain ridges, and foothills. Elevation ranges from 5,600 to 12,000 ft (1,706 to 3,657 m). This Section is within three geomorphic physical divisions: Fenneman and Johnson's Wyoming Basin (northern part of the Section), Southern Rocky Mountains (central part of the Section), and the Colorado Plateaus (southern part of the Section).

Lithology and Stratigraphy. The northern one-third of the Section is predominantly Cretaceous sandstones, siltstones, shales, and coals, with local porphyritic intrusives. This part of the Section includes the White River uplift, the northeastern part of which is Tertiary basalt. Much of the remaining two-thirds is structurally complex and includes Lower Paleozoic carbonates and shales and Upper Paleozoic conglomerates, sandstones, siltstones, shales, and evaporites. In the central part of the Section are Precambrian granite and biotite gneiss. In the extreme south are volcanic rocks, including ash flow tuffs, andesitic lavas, breccias, and conglomerates.



North-Central Highlands and Rocky Mountain Section in the White River National Forest.

The lower elevations in the southern two-thirds of the Section are Cretaceous and Tertiary sandstones, siltstones, shales, and local coals. The rock types in this area make it highly susceptible to slope failure. The southern part of the Section also includes local glacial drift and morainal deposits.

Soil Taxa. There are mesic, frigid, and cryic temperature regimes. Soils include Mollisols, Alfisols, Inceptisols, and Entisols, including Boralfs, Borolls, Ochrepts, Orthids, and Orthents.

Potential Natural Vegetation. Küchler mapped vegetation as western spruce-fir forest, pine-Douglas-fir forest, juniper-pinyon woodland, mountain mahogany-oak scrub, and sagebrush steppe. Above timberline, alpine tundra predominates. At higher elevations types include Engelmann spruce, subalpine fir, Douglas-fir, ponderosa pine-Douglas-fir, aspen, and meadows of grass and sedge. At lower elevations, there are pinyon pine, shrubs, grass, and shrub-grass vegetation.

Fauna. Elk, mule deer, black bear, and mountain lion are typical large mammals of this Section. Rocky Mountain bighorn sheep inhabit the higher elevations. Common smaller mammals include marmot, beaver, snowshoe hare, pika, and pine marten. Typical forest-dwelling avifauna include Clark's nutcracker, grey jay, northern flicker, and Steller's jay. White-tailed ptarmigan inhabit the higher elevations. Mountain bluebirds are common summer nesters. Herpetofauna include chorus frogs, leopard frogs, and western garter snakes. Native cutthroat trout have been displaced in much of their former range by brook, rainbow, and brown trout.

Climate. Precipitation ranges from 7 to 45 in. (170 to 1,140 mm). Temperature averages 32 to 45 °F (0 to 7 °C). The growing season lasts 70 to 140 days.

Surface Water Characteristics. In the mountains, water from streams and lakes is abundant, and ground water is plentiful. Snowfields exist on upper slopes and crests. Major rivers in this Section include Yampa, White, Colorado, Eagle, Arkansas, Taylor, Gunnison, Crystal, Roaring Fork, and Frying Pan.

Disturbance Regimes. Fire, insects, and disease are the principal sources of natural disturbance.

Land Use. More than 50 percent of the mountain area is Federally owned; the remainder is in farms, ranches, and other private holdings. About 50 percent of the park area is federally owned and is leased to ranchers for grazing of cattle and sheep; the remainder is privately owned ranches. There are some irrigated pastures adjacent to the rivers and streams in the park area. Recreation, mining, and timber harvest are land uses in this Section.

Cultural Ecology. Reserved.

Compiled by Rocky Mountain Region.

Section M331I-Northern Parks and Ranges

Geomorphology. Steeply sloping to precipitous mountains are dissected by many narrow stream valleys with steep gradients. This area has gently rolling mountain parks and valleys, with some mountain ridges. Rugged hills and low mountains are found in narrow bands along the eastern slopes of the Rocky Mountains. These hills are strongly dissected and in many places are crossed by large streams flowing eastward from the mountains. Elevation ranges from 5,575 to 14,410 ft (1,700 to 4,400 m). This Section is within Fenneman and Johnson's Southern Rocky Mountains geomorphic physical division.

Lithology and Stratigraphy. Most of the Section is Precambrian granite and biotitic, felsic, and hornblende gneiss. North, south, and middle parks have local Pennsylvanian through Cretaceous sandstones, siltstones, and shales. Between middle and south parks are local Tertiary porphyritic intrusives.

Soil Taxa. This Section has mesic, frigid and cryic temperature regimes. Soils include Mollisols, Alfisols, Inceptisols, and Entisols, including Boralfs, Borolls, Ochrepts, Orthids, Orthents, and Ustolls.

Potential Natural Vegetation. Küchler mapped vegetation as alpine meadows and barren, fescue-mountain muhly prairie, sagebrush steppe, juniper-pinyon woodland, and Great Basin sagebrush.

Fauna. Common mammals of this Section are elk, mule deer, black bear, and mountain lion. Rocky Mountain bighorn sheep and isolated mountain goat populations inhabit the higher elevations. Smaller mammals include beaver, marmot, pika, pine marten, and bobcat. Common



Northern Parks and Ranges Section.

forest-dwelling birds are Steller's jay, Clark's nutcracker, and grey jay. Wild turkeys are not numerous but are present. At higher elevations, white-tailed ptarmigan are present. Mountain bluebirds and broad-tailed hummingbirds are frequently seen summer residents. Herpetofauna present are western garter snakes and leopard frogs; prairie rattlesnakes live at lower elevations in the eastern part of the Section. Native cutthroat trout have been displaced to a large extent by introduced brook, rainbow, and brown trout.

Climate. Precipitation ranges from 5 to 50 in (120 to 1,120 mm). Temperature averages 32 to 50 °F (0 to 10 °C). The growing season ranges from less than 70 to 160 days.

Surface Water Characteristics. In the mountains, water from streams and lakes is abundant, and ground water is plentiful. Snowfields occur on upper slopes and crests. In the parks, perennial streams originate from snowmelt; by August, these streams are often short of water. Large reservoirs store water for domestic, power, and irrigation uses outside the mountain park area. Major streams cross the foothills area, but elsewhere water is scarce. The Arkansas, North Platte, Laramie, Fraser, Yampa, White, Crystal, Roaring Fork, Frying Pan, and Colorado are major rivers in this Section.

Disturbance Regimes. Fire, insects, and disease are predominate sources of natural disturbance.

Land Use. About 50 percent of the mountain area is Federally owned; the remainder is in farms, ranches, and other private holdings. About 50 percent of the park area is Federally owned; the rest is private ranches. Less than 20 percent of the foothills area is Federally owned, and about 80 percent is farms and ranches. Irrigation occurs along some rivers and streams in park areas and in some small mountain valleys. Grazing use is heavy, occurring on open mountain woodlands and grasslands, on almost all of the park areas, and on the woodlands and grasslands of the foothills. Recreation, mining, and timber harvest are present and past uses.

Cultural Ecology. Reserved.

Compiled by Rocky Mountain Region.

Section M331J—Wind River Mountains

Geomorphology. This Section, which occurs within the Middle Rocky Mountain physiographic province, is located in western Wyoming. It has high alpine mountains that have been glaciated. Glacial troughs, cirque headwalls,



Wind River Mountain Section.

and floors are common. The highest areas have glaciers covering the mountain tops. Elevation ranges from 6,000 to 13,000 ft (1,800 to 4,100 m).

Lithology and Stratigraphy Areas of orthogneiss and paragneiss with Precambrian granites occur. Precambrian metasedimentary rocks also occur, with Quaternary deposits on the west side.

Soil Taxa. Inceptisols, Mollisols, Histisols, Alfisols, and Entisols are in mostly cryic soil temperature regimes, with some pergelic at higher elevations, along with ustic, udic, and aquic soil moisture regimes. Fluvents and Aquolls occur in the valleys.

Potential Natural Vegetation. Kuchler vegetation types include lodgepole pine and alpine grasses and forbs. Areas of spruce-firs and Douglas-fir forest occur in this Section.

Fauna. This Section was once characterized by bison and large carnivores such as the gray wolf and grizzly bear. These species have been reduced, primarily at the hand of man, yet occasionally are still reported in the area. Currently, large ungulates include Rocky Mountain elk, mule deer, bighorn sheep, antelope, and moose; cougar, black bear, and coyote comprise the large predator component. Historical and present-day herpetofauna include the Wyoming and western toads; spotted and northern leopard frogs; tiger salamander; short-horned and sagebrush lizards; the gopher snake, rubber boa, racer, and several species of garter. Habitats in this Section support a rich and diverse avifauna of neotropical migratory land birds; waterfowl, including trumpeter swans and common loons; raptors, including bald and golden eagles and peregrine falcon; and gallinaceous species. The Colorado River cutthroat trout represents the historic salmonid component. In addition, rainbow,

brown, brook, golden, mackinaw, and hybrid trout, plus arctic grayling occurs. Rocky Mountain whitefish, speckled dace, squawfish, and other fish also now inhabit the waters here. Of special note is the Kendall Warm Springs dace, found only in this Section and only in one stream.

Climate. Precipitation ranges from 15 to 100 in (375 to 2,550 mm) annually, increasing with elevation. Most occurs during fall, winter and spring as snow, with many summer rains occurring during the growing season. Temperature averages 34 to 47 °F (2 to 8 °C); lower temperatures occur at the highest elevations. The growing season ranges from 25 to 120 days; higher elevations have 0 to 45 days.

Surface Water Characteristics. Many perennial streams and glacial lakes occur. Ground water supplies are small and mostly untouched. The Section is drained by the Green, Wind, and Sweetwater Rivers. Many lakes and wet meadows are associated with higher areas above 8,000 ft. Large lakes include New Fork, Fremont, Willow, Burnt, and Boulder.

Disturbance Regimes. Mass movements are infrequent, and erosion is occurring from water.

Land Use. All forested areas are used as wildlife habitat, for recreation, including wilderness, and as watershed. Timber production is important in small areas of this Section. Livestock grazing is also an important use.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.

Province M332–Middle Rocky Mountain Steppe - Coniferous Forest - Alpine Meadow

Seven Sections have been delineated in this Province: M332A–Idaho Batholith; M332B–Bitterroot Valley; M332C–Rocky Mountain Front; M332D–Belt Mountains; M332E–Beaverhead Mountains; M332F–Challis Volcanics; and M332G–Blue Mountains. These Sections are located in the northwestern conterminous States, including parts of Oregon, Washington, Idaho, and Montana. The area of these Sections is about 81,800 mi² (211,900 km²).

Section M332A–Idaho Batholith

Geomorphology. These are mountains with alpine ridges and cirques at higher elevations. Large U-shaped valleys with broad bottoms indicate that the area has been strongly glaciated. Mature surfaces are dissected with major drainages deeply incised, resulting in steep breaklands. Elevation ranges from 3,000 to 10,000 ft (900 to 3,000 m). Local relief ranges from 3,000 to 5,000 ft (900 to 1,500 m). This Section is within the Northern Rocky Mountains physiographic province.

Lithology and Stratigraphy. Lower Tertiary and Mesozoic granite forms the Idaho Batholith. Areas of Tertiary and Quaternary sediments and basalts have also been identified.

Soil Taxa. There are Frigid and cryic Ochrepts and Boralfs, with some Udands and Cryands occurring on areas where significant volcanic ash has accumulated. Soils are generally shallow to moderately deep, with loamy to sandy textures. Volcanic ash accumulations in some soils causes them to be very productive.

Potential Natural Vegetation. Küchler mapped vegetation as grand fir–Douglas-fir forest, western spruce–fir forest, and western ponderosa forest.

Fauna. Birds are typical of the northern Rocky Mountains, including such species as Steller's jay, olive-sided flycatcher, and western wood-pewee. Specialists include flammulated and boreal owl, Lewis' woodpecker, Townsend's solitaire, and Nashville and yellow-rumped warblers. Several species nearing the edge of their ranges are mountain quail, spruce grouse, chestnut-backed chickadee, red-eyed vireo, Townsend's warbler, and American redstart. Typical herbivores and carnivores include white-tailed deer, mule deer, elk, mountain goat, moose, black bear, bobcat, and cougar. Common smaller herbivores include the snowshoe hare and the northern flying squirrel. Rare species associated with this Section includes grizzly bear, gray wolf, lynx, fisher, and wolverine. Herpetofauna typical of this Section are the spotted frog, wood frog, Pacific treefrog, western toad, long-toed salamander, and the Pacific giant salamander.

Climate. Precipitation ranges from 20 to 80 in (510 to 2,030 mm). Most occurs during fall, winter, and spring as snow. Storms are cyclonic from the Pacific Ocean. Climate is maritime-influenced, cool temperate with dry summers. Mean air temperature ranges from 35 to 46 °F (2 to 7 °C), but may be as low as 24 °F (-4 °C) in the high mountains. The growing season lasts 45 to 100 days.

Surface Water Characteristics. Many perennial streams and lakes occur. Lakes include Payette Lake, Cascade Reservoir, Warm Lake, and Redfish Lake. Breaklands have very steep, straight tributaries with a high sediment delivery efficiency. Older surfaces have much gentler, complex dendritic and structurally-controlled drainage patterns with much lower sediment delivery efficiencies. Major rivers include the Salmon and Payette.

Disturbance Regimes. Fire, insects, and disease are the dominant natural sources of disturbance. Fires have been frequent, low intensity, and patchy, and occasionally high intensity and continuous. Mass wasting is also an important source of disturbance in some areas.

Land Use. Timber harvest is the dominant land use, with some grazing also occurring. Mining and recreational uses are also important.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Section M332B–Bitterroot Valley

Geomorphology. This area includes high, glaciated mountains with alpine ridges and cirques at higher elevations and glacial and lacustrine basins at lower elevations. Steep slopes, sharp crests, and narrow valleys are characteristic. Elevation ranges from 2,500 to 6,000 ft (763 to 1,830 m) in basin areas; the range is 3,000 to 8,000 ft (915 to 2,440 m) in mountains, with some alpine areas up to 10,000 ft (3,050 m). This Section is within the Northern Rocky Mountains physiographic province.

Lithology and Stratigraphy. Lower Tertiary, Mesozoic, and Precambrian granite and metasedimentary rock occur.

Soil Taxa. There are frigid and cryic Ochrepts, Boralfs, and Orthents, with significant areas of rockland and talus. Soils in basins are Borolls, Ochrepts, and Fluvents. Xeric intergrades probably occur. These soils are generally shallow to moderately deep, with loamy or sandy textures containing large amounts of rock fragments. Some soils at higher elevations are moderately influenced by volcanic ash accumulations.



Glaciated Bitterroot Mountain Range, Montana.

Potential Natural Vegetation. Küchler classified vegetation as Douglas-fir forest and western ponderosa forest (80 percent) and foothills prairie (20 percent), mostly in the lower valleys. The upper timberline occurs at about 8,800 ft (2,667 m). Common tree species include western larch, Douglas-fir, subalpine fir, and ponderosa pine. Grassland species are mainly bluebunch wheatgrass, Idaho fescue, and rough fescue.

Fauna. Birds are typical of the northern Rocky Mountains, including species such as black-capped chickadee, Steller's jay, and western tanager. The slightly drier and more open areas also provide habitat for dryland species such as sage grouse, black-billed magpies, and horned larks. Other species of note are the harlequin duck, flammulated owl, Lewis' woodpecker, black-backed woodpecker, American dipper, and Nashville warbler. Species near the edge of their range are pileated woodpecker, chestnut-sided chickadee, and Townsend's warbler. Typical herbivores and carnivores include white-tailed deer, mule deer, elk, moose, black bear, bobcat, and cougar. Smaller common herbivores include the snowshoe hare and the northern flying squirrel. Rare species include the grizzly bear, gray wolf, lynx, wolverine, and northern bog lemming. Herpetofauna typical of this Section are the spotted frog and long-toed salamander.

Climate. Precipitation ranges from 14 to over 80 in (360 to 2,030 mm). Most of the precipitation in fall, winter, and spring is snow. Climate is cool temperate with some maritime influence. Summers are relatively dry. Temperature averages 36 to 46 °F (2 to 8 °C). The growing season lasts 45 to 130 days.

Surface Water Characteristics. Many perennial streams with dendritic and structurally controlled patterns occur. Many third order drainages are deeply incised into narrow, V-shaped canyons as they leave the mountains. Major rivers include the Bitterroot and the Clark's Fork.

Disturbance Regimes. Fire, insects, and disease are the dominant natural sources of disturbance. Fires were generally low intensity, frequent ground fires prior to fire suppression efforts. Fuel accumulations have now set the stage for large, high-intensity fires.

Land Use. Land use is mostly timber harvest with some livestock grazing. Mining and recreational uses are also important.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Section M332C–Rocky Mountain Front

Geomorphology. There are glaciated mountains with limestone scarps and ridges interspersed with glacial and lacustrine intermontane basins. Alpine ridges and cirques occur at higher elevations. Elevation ranges from 5,500 to 8,500 ft (1,678 to 2,593 m). This Section is within the Northern Rocky Mountains physiographic province.

Lithology and Stratigraphy. Precambrian and Paleozoic limestone and marine clastic rocks occur.

Soil Taxa. Soils include frigid and cryic Ochrepts, Boralfs, Orthents, and Borolls. Fluvents occur in the basin areas. These soils are generally shallow to moderately deep with loamy to sandy textures.

Potential Natural Vegetation. Douglas-fir forest and western spruce-fir forest (15 percent), occur mostly between 4,500 to 8,000 ft (1,360 to 2,425 m). Extensive aspen groves also occur. Limber pine is also present. Foothills prairie (85 percent) occurs on lower elevation foothills. Common grasses include wheatgrasses, fescues, and needlegrass.

Fauna. Birds are typical of the drier, open areas of the northern Rocky Mountains, including such species as common raven, black-capped chickadee, hermit thrush, Cassin's finch, and dark-eyed junco. Other birds include the harlequin duck, blue grouse, spruce grouse, gray jay, black-billed magpie, Clark's nutcracker, American dipper, Townsend's solitaire, American pipit, yellow-rumped warbler, fox sparrow, western tanager, and pine siskin. Several species meet the edge of their range at the intersection of Rocky Mountain and plain, including Vaux's swift. Typical herbivores and carnivores include white-tailed deer, mule deer, elk, moose, black bear, bobcat, and cougar. Smaller common herbivores include the snowshoe hare and the northern flying squirrel. Rare species include the grizzly bear and gray wolf. Herpetofauna typical of this Section are the spotted frog, wood frog, Pacific treefrog, western toad, and long-toed salamander.

Climate. Precipitation ranges from 18 to over 100 in (460 to 2,540 mm), with forests receiving an average of 30 to 40 in (760 to 1,020 mm). Maximum precipitation occurs from spring through early summer; winter precipitation is snow. Severe chinook winds and dramatic fluctuations of winter temperatures are common. Climate is cold continental. Temperature averages 36 to 45 °F (2 to 7 °C). The growing season averages 45 to 90 days.

Surface Water Characteristics. There is generally a dendritic drainage pattern with some structural control. Major water bodies include St. Mary's lake and Gibson reservoir. Smaller lakes occur in high elevation cirque basins. Major rivers include the Sun and the Middle Fork of the Flathead.

Disturbance Regimes. Fire, insects, and disease are the principal natural sources of disturbance. Strong

chinook winds that cause windthrow are also a source of disturbance.

Land Use. Livestock grazing is important, along with some timber harvest. Recreation, watershed, and wildlife habitat are other important land uses.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Section M332D–Belt Mountains

Geomorphology. This Section comprises high mountains, gravel-capped benches, and intermontane valleys bordered by terraces and fans. Plains and rolling hills surround the isolated mountain ranges. Elevation ranges from 4,000 to 8,500 ft (1,220 to 2,593 m) in the mountains; elevation ranges from 2,500 to 5,000 ft (763 to 1,525 m) on the plains. Most of this Section is within the Northern Rocky Mountains physiographic province, but the eastern part extends onto the Missouri Plateau within the Great Plains physiographic province.

Lithology and Stratigraphy. There are Paleozoic and Precambrian metamorphic and Cretaceous soft sedimentary rocks.

Soil Taxa. Frigid and cryic Ochrepts, Boralfs, and Borolls occur in the mountains. These soils are shallow to moderately deep with loamy to sandy textures. Frigid Orthents, Borolls, and Fluvents occur on the plains. These soils are generally moderately deep to deep with loamy to clayey textures.

Potential Natural Vegetation. Küchler classified vegetation as foothills prairie (75 percent) and Douglas-fir forest–eastern ponderosa forest (25 percent). Forests are associated with prominent mountain ranges and the Missouri River breaks, and cover all but the highest peaks. Typical prairie species include wheatgrasses, fescues, grama, and needlegrass. Common tree species are Douglas-fir, ponderosa pine, limber pine, and subalpine fir.

Fauna. Birds are typical of short-grass prairie or the drier portions of the Rocky Mountains. Species of note are ferruginous and Swainson's hawks, golden eagle, prairie falcon, sage grouse, Lewis' woodpecker, western kingbird, horned lark, yellow-rumped warbler, and lazuli bunting. Several birds near the extent of their range in this Section, including both eastern and western screech-owls, calliope hummingbird, red-headed woodpecker, mountain chickadee, Sprague's pipit, ovenbird, and McCown's longspur. Typical herbivores and carnivores include white-tailed deer, mule deer, elk, moose, black bear, bobcat, and cougar. Smaller common herbivores include the snowshoe hare and northern flying squirrel. Rare species include the northern bog lemming. Herpetofauna typical of this Section are the spotted frog, Pacific treefrog, western toad, and long-toed salamander.

Climate. Precipitation ranges from 10 to 40 in (250 to 1,020 mm), with maximum precipitation occurring in spring and early fall; winter precipitation is snow. Climate is cold continental. Temperature averages 36 to 45 °F (2 to 7 °C). Temperature extremes are common throughout the winter months; strong winds are common throughout the year. The growing season ranges from 45 to 140 days.

Surface Water Characteristics. Perennial streams have a dominantly dendritic drainage pattern and are fairly widely spaced. Some drainages are deeply incised as they leave the mountains. Holter and Canyon Ferry lakes are in this Section. Smaller lakes occur at higher elevations. Major rivers include the Missouri and the Smith.

Disturbance Regimes. Fire, insects, and disease are the principal natural sources of disturbance.

Land Use. Land uses are dominantly livestock grazing, timber harvest, watershed, wildlife habitat, and recreation.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Section M332E-Beaverhead Mountains

Geomorphology. This area encompasses complex and high, steep mountains with sharp alpine ridges and cirques at higher elevations, glacial and fluvial valleys, and alluvial terraces and flood plains. Elevation ranges from 2,500 to 6,500 ft (763 to 1,983 m) in valleys; elevation ranges from 4,000 to 10,000 ft (1,220 to 3,050 m) in the mountains. This Section is within the Northern Rocky Mountains physiographic province.

Lithology and Stratigraphy. Composition is complex, including Precambrian granitic, Paleozoic metamorphic, and Tertiary sedimentary and volcanic rocks.

Soil Taxa. Soils include frigid and cryic Ochrepts, Boralfs, and Borolls, with some Fluvents and Aquepts in alluvial valleys. Mountain soils are generally shallow to moderately deep and have loamy to sandy textures with rock fragments. Valley soils are moderately deep to deep and have loamy to clayey textures.

Potential Natural Vegetation. Vegetation consists of sagebrush steppe with small areas of alpine vegetation (75 percent) above 9,500 ft (2,880 m), and Douglas-fir forest (25 percent) the latter spans an elevation range of only about 1,000 to 1,500 ft (300 to 450). Typical steppe species include big sagebrush, fescues, wheatgrasses, and needlegrass. Douglas-fir, limber pine, and lodgepole pine are common tree species.

Fauna. Birds are similar to those in M332B, with a larger number of species typical of the Great Plains. Species of note are trumpeter swan, Barrow's goldeneye, Swainson's hawk, golden eagle, sage grouse, sandhill crane,



Tendoy Mountains, southwest Montana.

American dipper, Townsend's solitaire, and Brewer's sparrow. Birds nearing the edge of their range are spruce grouse, black-throated hummingbird, pileated woodpecker, eastern kingbird, red-eyed vireo, and northern water thrush. Typical herbivores and carnivores include white-tailed deer, mule deer, pronghorn, elk, moose, black bear, bobcat, and cougar. Smaller common herbivores include the snowshoe hare and northern flying squirrel. Rare species include the gray wolf, lynx, wolverine, pygmy rabbit, Great Basin pocket mouse, and the northern bog lemming. Herpetofauna typical of this Section are the spotted frog, wood frog, Pacific treefrog, boreal toad, western toad, and long-toed salamander.

Climate. Precipitation ranges from 10 to 50 in (250 to 1,270 mm). Most fall, winter, and spring precipitation is snow. Winters are cold, and growing season conditions are dry. Soil moisture is not sufficient for tree growth on some south and west aspects below timberline; hence, grasslands often extend from the valley floors to the mountain tops. Climate is cold dry continental. Temperature averages 36 to 46 °F (2 to 8 °C). The growing season ranges from 45 to 100 days.

Surface Water Characteristics. Drainage patterns are complex, reflecting the complex geology. Intermittent drainages are common, indicating the somewhat arid nature of the area. Lakes occur in glaciated areas at higher elevations. Major rivers include the Lemhi, Beaverhead, and Ruby.

Disturbance Regimes. Fire, insects, and disease are the principal natural sources of disturbance.

Land Use. Livestock grazing is the dominant land use. Limited timber harvesting, mining, wildlife habitat, and recreation are also important land uses.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Section M332F—Challis Volcanic

Geomorphology. This Section occurs within the Middle Rocky Mountain physiographic province. The Challis Volcanics Section is in central Idaho. Mountain ranges include White Cloud Peaks, Pioneer Mountains, Smokey Mountains, Boulder Mountains, White Knob Mountains, and portions of the Salmon River Range. Areas of glaciation occur in this Section. Most of the mountain ranges have residual weathering. Elevation ranges from 4,000 to 11,800 ft (1,200 to 3,600 m).

Lithology and Stratigraphy. Challis volcanic rocks, mostly Tertiary, dominate. Some areas of granite and Precambrian rock are in the western portion of the Section. Challis volcanics consist of latite-andesite flows, basalts, tuffs, and rhyolites. Precambrian rocks consist mainly of quartzite.

Soil Taxa. Alfisols, Mollisols, Inceptisols, and Entisols occur in combination with frigid and cryic soil temperature regimes, along with xeric, udic, and aquic soil moisture regimes.

Potential Natural Vegetation. Küchler vegetation types include a mixture of western spruce-fir forest and sagebrush steppe. Douglas-fir forest occurs also in this Section. The Soil Conservation Service identifies the potential natural vegetation as mixed conifer forest. Also

included are areas of Lodgepole Pine series. Whitebark Pine and Subalpine Fir series also occur at the highest elevations. Areas of Big Sagebrush series are on southerly exposure and at lower elevation.

Fauna. Characteristic mammals include mule deer, elk, bighorn sheep, mountain goat, pronghorn, and moose. Bison, once present, are now extirpated. Feral or wild horses arrived in the area in the late 1700's. Predators include bobcat, wolverine, marten, coyote, red fox, black bear, and mountain lion. The gray wolf and grizzly bear have been extirpated from the area; however, the gray wolf may be re-colonizing from northern populations. Grouse (sage, blue, ruffed, and spruce), northern goshawk, northern flicker, dark-eyed junco, mountain chickadee, and black-billed magpie are representative avian species. Concentrations of wintering bald eagles use the large riverine habitats. Peregrine falcon historically nested within the Section. Herpetofauna is represented by the spotted frog, western toad, sagebrush lizard, western rattlesnake, gopher snake, and the western garter snake. Chinook salmon and steelhead and bull trout were once common, but are now greatly reduced in number and distribution.

Climate. Precipitation ranges from 10 to 45 in (250 to 1,200 mm) annually, with an average of 22 in. Most occurs during fall, winter, and spring. High mountain barriers to the west reduce precipitation due to a rain shadow effect. Climate is influenced by prevailing winds from the west and the general north-south orientation of the mountain ranges. Summers are dry with low humidity. Precipitation during the frost-free period is 30 to 40 percent of the evaporation potential. The mean annual air temperature is 34 to 50 °F (3 to 10 °C), but may be as low as 24 °F (-4 °F) in the high mountains. The growing season ranges from 70 to 120 days.

Surface Water Characteristics. This Section is primarily drained by the Wood River, Big Lost River, and the Salmon River. Many perennial streams exist.

Disturbance Regimes. Common high intensity forest fires occur during summer thunderstorms. Erosion by water is occurring.

Land Use. Forest related industries and livestock production are important in this Section. Approximately 50 percent of the land is forested and used for timber production and livestock grazing. Mining is also an important use that produces gold and silver. Recreation remains very important.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.



Mount Borah, the highest point in Idaho, is more than 12,000 feet above sea level; it is located in the Challis Volcanics Section.

Section M332G-Blue Mountains

Geomorphology. This is a moderately dissected wide, uplifted plateau dominated by landslide and fluvial erosion processes in the western portion. Mesas and buttes are common. Moderately dissected mountains dominated by glacial and fluvial erosion processes are in the eastern half. From the low-lying Ochoco Mountains in the southwest, individual ranges, separated by north-south trending valleys, rise to ice-sculpted peaks and deep canyons in the Wallowa Range. Wide, low elevation valleys between ranges are alluvium-filled fault troughs. Elevation ranges from 1,000 to 10,000 ft (300 to 3,300 m). Most of the mountainous part of the Section is between 4,000 and 7,500 ft (1,212 and 2,273 m), and the valleys are less than 4,000 ft (3,030 m). Local relief is 2,000 ft (606 m) or more in the mountains and 100 to 500 ft (30 to 150 m) on the broad valley floors.

Lithology and Stratigraphy. Five Paleozoic accreted terrains, composed of metamorphic and volcanic island arc sequences, are recognized. These and Late Mesozoic plutons cover the central to eastern portion. Portions have a thin veneer of glacial debris. The western area is composed of Eocene, Miocene, and Oligocene tuffs, siltstones, sandstones with basalts, andesites, and rhyolites. Some areas are overlain by up to 1,000 ft (330 m) of multi-flow Miocene basalts.

Soil Taxa. Most soils in this Section are influenced by a mantle of volcanic ash from Mount Mazama. The ash mantle is relatively undisturbed in places, on gentle north slopes under forest canopy. On southerly exposures, the ash has been mostly removed by erosion. Commonly the ash is re-deposited and mixed with loess, colluvium, and alluvium from other sources. In the high mountains are cold, usually moist soils with relatively high amounts of volcanic ash and low base saturation. Some have dark, organic matter-rich surface layers (Humic Vitricryands; Vitrandic, Typic, and Lithic Cryumbrepts); others have clay-enriched subsoils (Alfic Vitricryands; Andic or Vitrandic Cryoboralfs); and in wet meadows are soils with a high water table and an organic surface layer (Histic Cryaquepts). At lower elevations, are cool, usually moist soils with a thick ash mantle (Typic Udivitrands) and clay-enriched subsoil (Alfic Udivitrands; Andic and Vitrandic Eutroboralfs).

On lower mountain slopes, soils are dry in late summer and base saturation is greater than in the high mountains. Some soils have relatively high amounts of volcanic ash (Typic Vitrixerands) with an organic matter-rich surface layer (Humic Vitrixerands) or with a clay-enriched subsoil (Alfic Vitrixerands). Other soils have medium amounts of ash (Vitrandic Haploxeralfs and Xerochrepts) and an organic matter-rich surface layer (Vitrandic Argixerolls and Haploxerolls). Soils with little volcanic ash have



Typical moderately dissected uplifted plateau with grand fir and Douglas-fir forests on xeric to udic, frigid Andisols (foreground) and wheatgrass-bluegrass communities on xeric and mesic Mollisols in canyons and south slopes.

organic matter-rich surface layers, with or without clay-enriched subsoil (Typic, Lithic, Ultic, and Pachic Argixerolls and Haploxerolls). On valley floors, soils under a grass-shrub vegetation are dry for most of the summer and have organic matter-rich topsoil with high base saturation (Typic, Lithic, and Pachic Argixerolls and Haploxerolls).

Potential Natural Vegetation. The Küchler vegetation types are dominantly grand fir–Douglas-fir forests, followed by western ponderosa forests. High elevation forests are western spruce-fir. Great basin sagebrush and juniper steppe woodland are interspersed on relatively dry, mesic regime sites. Wheatgrass-bluegrass occurs on mesic-xeric soils in canyons and south slopes. Alpine meadows and barrens occupy the highest elevations. Grand fir and Lodgepole Pine are the dominant series and are at mid elevations on the moderately deep and deep volcanic ash soils with frigid temperature regimes and udic to xeric moisture regimes. Some lodgepole pine is on cryic soils. Ponderosa Pine series dominates at mid to low elevations on mesic and frigid xeric soils. Douglas-Fir series is intermediate between the Lodgepole Pine and Ponderosa Pine series. Subalpine Fir series dominates at the highest elevations on cryic soils. Western Juniper series occurs at low elevations on mesic and xeric soils. Shrub series of Snowberry, Mountain Mahogany, Bitterbrush, Common Snowberry, and Low Sage are interspersed. Grasslands are at the highest and lowest elevations. High elevation, cryic soils are dominated by green and Idaho fescues, and sedges. At mid and low elevations, Idaho fescue and bluebunch wheatgrass, occur with lesser amounts of Sandbergs bluegrass and prairie junegrass. Wet meadows are dominated by sedges and tufted hairgrass.

Fauna. The principal mammals are Rocky Mountain elk, mule deer, black bear, cougar, bobcat, and coyote. Elk and deer populations have fluctuated widely since settlement due to changes in vegetative cover. Several fur bearers are common, including beaver, pine marten, raccoon, and fisher; they occur in a variety of habitats. A wide variety of birds occupy various habitats. Hawks, golden eagle, chukar, owls, and a variety of song birds inhabit cliffs and talus slopes. A variety of cavity nesters, including pileated woodpecker, other woodpeckers, nuthatches, chickadees, bluebirds, and others, are dispersed throughout the Section. Anadromous fish include chinook and coho salmon and steelhead, but are at diminished levels and are on threatened or endangered lists. Resident fish include rainbow, bull trout, and brook trout. A variety of amphibians and reptiles are common.

Climate. Precipitation averages 9 to 18 in (230 to 460 mm) in the valleys and 17 to 100 in (430 to 2,540 mm) in the mountains. Temperature ranges from 28 to 52 °F (-2 to 11 °C). The growing season ranges from less than 30 to 130 days.

Surface Water Characteristics. Stream density varies from 1.5 to 2 mi/mi² (3.9 to 5.2 km/km²) wetter areas, to no perennial streams in drier areas. Numerous springs are scattered throughout the Section. Some alpine lakes are clustered in high elevation glacial areas. Reservoirs are on several streams. The Snake River canyon is a major feature near the eastern edge of the Section.

Disturbance Regimes. Fire was a major factor in disturbance until the early the advent of fire control in the early 20th century. Periodicities ranged from as few as 10 to 15 years, to as infrequent as several decades on the cooler and wetter sites. A variety of insects, including beetles, tussock moth, spruce budworm, and others, are endemic; periodic epidemics appeared and declined until recently. Epidemic occurrences have had significant effects in the recent decade. A variety of diseases also have had some local effects. Periodic floods and ice jams are important in some watersheds.

Cultural Ecology. Humans have occupied the Blue Mountains and high lava plains for at least 12,000 years. This region exhibited prehistoric lifestyles that were transitional between Great Basin cultural patterns to the south and Columbia Plateau cultural patterns to the north. Root digging, seed and berry gathering, hunting, and fishing were the primary economic activities, and their relative importance shifted with changing climatic conditions. Peoples tended to live in groups comprising a couple of families during much of the year to utilize resources that were scattered over the landscape and ripened at different times. Several such groups would come together seasonally at camps on rivers, streams, or large upland meadows to exploit concentrated resources and utilize stored resources. Burning was practiced to improve the production of berries, big game forage, and to drive game. Extensive deposits of obsidian and basalt were intensively used, and these materials were re-distributed widely. Euro-American settlement and exploitation of the area began in the mid 1800's and intensified during the 1860's with the discovery of gold. Locally heavy alteration to the landscape and hydrology occurred due to hydraulic mining and attendant ditch building and use, later followed by hardrock mining and dredging. Mineral extraction and activities related to improved transportation systems and agriculture led to relatively large settled human populations. Logging, logging railroad construction, cattle and sheep grazing, and fire suppression have also played a significant role in alteration of the environment. Historic uses of the land created ecological effects on plant and animal species and other resources that far exceed those from prehistoric times.

Compiled by Pacific Northwest Region.

Province M333–Northern Rocky Mountain Forest-Steppe - Coniferous Forest - Alpine Meadow

Four Sections have been delineated in this Province: M333A–Okanogan Highlands, M333B–Flathead Valley, M333C–Northern Rockies, and M333D–Bitterroot Mountains. These Sections are located in the northwestern conterminous States, including parts of Washington, Idaho, and Montana. The area of these Sections is about 38,100 mi² (98,700 km²).

Section M333A–Okanogan Highlands

Geomorphology. This Section's features range from accretion of continental shelf material forming the Okanogan Highlands, in response to the uplifting and movement of the oceanic shelf to the east, to the Rocky Mountain facies and volcanic influences from the rise of the Kettle Dome. Extreme metamorphism and deformation have occurred, as well as deposits of glacial till, outwash, and debris that cover most of the modern landscape. Glacial lakes, rivers, and streams are common, as well as mountains, and both narrow and broad valleys. Elevation ranges from 1,376 to 7,309 ft (444 to 2,358 m). Local relief ranges from 500 to 1,000 ft (161 to 322 m).

Lithology and Stratigraphy. Types include Precambrian metamorphics; Mesozoic intrusives and metamorphics; Tertiary intrusives, sedimentary rocks and extrusive volcanics; and Quaternary colluvium, alluvium, glacial debris, glacial outwash, and glacial till.

Soil Taxa. In the high mountains there are cold (cryic), usually moist (udic) soils under coniferous forest with volcanic ash and relatively low base saturation (Typic Vitricryands; Andic and Vitrandic Cryochrepts); soils with dark, organic matter-rich topsoil and medium base saturation (Vitrandic and Pachic Cryoborolls); and on high-mountain basin floors there are soils with a water table near the surface and organic topsoil (Histic Cryaquolls). On the medium elevation mountain slopes that dominate this Section, there are cool (frigid), cobbly, and stony soils (Typic and Lithic Vitrixerands; Andic and Vitrandic Xerochrepts); that are formed by materials with variable amounts of volcanic ash and that are dry during late summer; there are also soils with dark, organic matter-rich topsoil (Vitrandic Haploxerolls).



Typical rounded landscape from continental glaciation. The denser mixed conifer forest is supported by a mixture of soils from glacial till and volcanic ash that are Andisols and Inceptisols. Glacial scour has left exposed rock on many slopes.

On valley floors and foothills along major drainages are warm (mesic) soils that are usually dry during the summer (xeric). These include stratified, gravelly soils and cobbly, well drained soils with dark topsoil on terraces (Cummulic and Fluventic Haploxerolls) and poorly drained soils on floodplains (Fluvaquentic Haplaquolls). On foot slopes above the valley floor there are soils formed in till and colluvium from the ice-scoured valley walls. Many of these soils have dark, organic matter-rich topsoil with variable depth to bedrock, topsoil thickness, and amount of volcanic ash (Typic, Pachic, Lithic, and Vitrandic Haploxerolls); also, soils without the dark topsoil (Typic Xerochrepts) are common.

Potential Natural Vegetation. Vegetation pattern in this Section is strongly influenced by the strong east-west precipitation gradient. Vegetation in the western third of the Section found west of the Kettle Mountains crest differs significantly from that in the eastern two-thirds. The Big Sagebrush series dominates the lowest elevations on mostly xeric soils. The Ponderosa Pine series occurs at slightly higher elevations also on xeric soils. This series is replaced by the Douglas-fir series at higher elevations. Soils with this series have a xeric moisture regime and mesic or frigid temperature regimes. The Subalpine Fir series occupies higher elevations to upper forest line on cryic soils.

Vegetation east of the Columbia River is characterized by the Douglas-fir series at lowest elevations followed by the Grand Fir series, Western Hemlock and Western Red Cedar series, and the Subalpine Fir series with increasing elevation. The Douglas-fir and Grand Fir series occur on xeric soils, with the Grand Fir series occupying slightly cooler and more mesic habitats. The Western Hemlock and Western Red Cedar series occur on soils with udic regimes. The Subalpine Fir series occurs on cryic soils. The Whitebark Pine series and the Green Fescue series occur at the highest elevations throughout the Section above continuous forest line.

Fauna. Birds of this Section are generally typical of the forested portions of the Rocky Mountains. These include rufous hummingbird, Steller's and gray jays, common raven, varied thrush, mountain bluebird, solitary vireo, Townsend's warbler, western tanager, and red crossbill. Birds which reach or nearly reach their southern, eastern, or western geographical extent in this Section are spotted owls (replaced by barred owls in the eastern portion of this Section), hawk owl, boreal chickadee, red-eyed vireo, American redstart, and white-winged crossbill. The Section's abundant water systems provide for a very high population of waterfowl, osprey and bald eagle. Other threatened, endangered, or rare species include harlequin duck and upland sandpiper (in the lowlands). The woodland caribou reach the southern portion of their range within this mapping Section. Typical herbivores and carnivores include white-tailed deer, mule deer, bighorn sheep, elk, moose, black bear, bobcat, and cougar. Smaller common herbivores include the snowshoe hare and northern flying squirrel. Rare mammals associated with this Section include grizzly bear, woodland caribou, gray

wolf, lynx, fisher, wolverine, and northern bog lemming. Herpetofauna typical of this Section are the spotted frog, wood frog, Pacific treefrog, western toad, and long-toed salamander and possibly the Pacific giant salamander.

Climate. Precipitation occurs mostly as snow. Thirty to 80 in (760 to 2,030 mm) occur per year. Rain on snow is common. June and July are very wet months. August through November is dry. Humidity is low year round. The climate is maritime-influenced. Adequate soil moisture is generally present during the growing season on all but the most severe sites. Annual average temperatures range from a minimum of 30 to 58 °F (-1 to 14 °C), with a mean temperature of 44 °F (7 °C). Warmest months are late July through August. The growing season generally 45 to 120 days, but as long as 140 days in some lower valleys.

Surface Water Characteristics. There is a high frequency of rapidly flowing rivers and streams during June. Rivers follow faults in the crust over the Kettle dome to the west. The Pend Orielle and the Columbia Rivers both run from the north to the south, with tributaries entering from the northeast and northwest predominantly. Most creeks flow through glacial outwash and debris material within narrow valleys. There are many glacial lakes and wet meadows associated with the last retreat of the glaciers in northeastern Washington.

Disturbance regime. Historic fire events have changed a large portion of the forest. Changes are periodic and range from high intensity, high severity, continuous fires to low severity, infrequent fires. Composition and successional sequences of some communities has changed because of harvesting practices and the introduction of animal species into the valleys. Wide fluctuations in precipitation and temperatures for periods of years result in significant changes in biological communities. Insects and diseases are frequent disturbance features.

Land Use. The Section is mostly rural. Forestry, livestock grazing, mining, and localized agriculture are principal uses. Communities are mostly small. Summer residences are common at lakes and large river systems. Outdoor recreation in all seasons is rapidly increasing.

Cultural Ecology. Humans have occupied the Okanogan Highlands Section for at least 12,000 years. For the last 5,000 years, groups spent much of the year in river-oriented pithouse villages of 30 to 300 people. Hunting, salmon fishing, and root and berry collecting were the primary economic activities. They were also the backdrop for much of the social organization and spiritual beliefs. Hunting and fishing were important not only for the sustenance they provided, but for where, when, and how they were carried out. Burning (both intentional and otherwise) to improve plant growth for berry crops and big game forage was common; however, hunting pressure prior to Euro-American settlement may have contributed to the extinction of the Columbia Basin bison population (never a large population at any time in prehistory).

Large pithouse villages with between 30 and 200 pit depressions have created small-scale localized ecological effects. Euro-American settlement and exploitation of the area began in the mid 1800's and intensified between 1875 and 1925. Historic activities—including lumbering (especially in the Okanogan Highlands), railroad construction, dam building, grazing, wheat ranching, and irrigated farming—have all created ecological effects on plant and animal species and other resources that far exceed most of those from prehistoric times.

Compiled by Pacific Northwest Region and Northern Region.

Section M333B—Flathead Valley

Geomorphology. There are glaciated mountains, glacial moraines, large glacial troughs, and glacial and lacustrine basins. Elevation ranges from 2,000 to 7,000 ft (610 to 2,135 m). This Section is within the Northern Rocky Mountains physiographic province.

Lithology and Stratigraphy. Types include predominantly Precambrian metasedimentary rocks of the Belt supergroup, with glacial deposits and valley fill.

Soil Taxa. Soils include frigid and cryic Ochrepts, Boralfs, Orthents, Udands, and Cryands in the mountains, with Borolls, Ochrepts, Xerolls, Psamments, and Fluvents

in the basins and valleys. These soils are generally moderately deep to deep with loamy to sandy textures. Most of the soils have been strongly influenced by volcanic ash deposits, which make them very productive.

Potential Natural Vegetation. Küchler mapped vegetation as Douglas-fir forest and western ponderosa forest. Principal tree species include Douglas-fir, ponderosa pine, hemlock, cedar, and grand fir.

Fauna. Birds are typical moist northern Rocky Mountain species, including Vaux's swift, calliope hummingbird, pileated woodpecker, gray jay, red-eyed vireo, and Townsend's warbler. Other species of note are common and Barrow's goldeneyes, harlequin duck, osprey, boreal owl, barred owl, Cordilleran flycatcher, American dipper, and varied and Swainson's thrush. Species nearing the edge of their range are the boreal and chestnut-backed chickadees, and northern water thrush. The endangered bald eagle is a relatively common breeder in this Section. Typical herbivores and carnivores include white-tailed deer, mule deer, elk, moose, black bear, bobcat, and cougar. The woodland caribou were historically present within this Section but are now absent. Smaller common herbivores include the snowshoe hare and northern flying squirrel. Rare mammals include the grizzly bear, gray wolf, lynx, fisher, wolverine, northern bog lemming, and the Coeur d' Alene salamander. Herpetofauna typical of this Section are the spotted frog, wood frog, Pacific treefrog, western toad, and long-toed salamander.



Mission Mountains in the Flathead Valley Section of northwestern Montana. Alva Lake is in the foreground.

Climate. Precipitation ranges from 18 to over 100 in (460 to over 2,540 mm); most of the precipitation in fall, winter, and spring is snow; summers tend to be dry. Climate is cool temperate with some maritime influence. Temperature averages 36 to 45 °F (2 to 7 °C). While maritime influences are present and winters are relatively mild, outbreaks of arctic air occur frequently in winter. The growing season ranges from 45 to 120 days.

Surface Water Characteristics. Several major rivers, including the Yaak and Kootenai, and many perennial streams with dendritic drainage patterns dominate the area. There are many lakes, including Lake Koocanusa and Flathead Lake, as well as bogs, and wetlands.

Disturbance Regimes. Fire, insects, and disease are the principal natural sources of disturbance.

Land Use. Timber harvest, wildlife habitat, and recreation are important land uses. Livestock grazing and farming occur in some valley areas.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Section M333C–Northern Rockies

Geomorphology. There are steep glaciated overthrust mountains with sharp alpine ridges and cirques at higher elevations. Some areas of glacial deposition also occur. Elevation generally ranges from 3,000 to 9,500 ft (915 to 2,898 m). Some alpine areas range from 8,000 to 10,000 ft (2,440 to 3,050 m). This Section is within the Northern Rocky Mountains physiographic province.

Lithology and Stratigraphy. Precambrian metasedimentary and Upper Tertiary soft sedimentary rocks occur; glacial deposits are also present.

Soil Taxa. Soils include frigid and cryic Ochrepts, Boralfs, and Orthents. These soils are generally shallow to moderately deep, with loamy to sandy textures containing rock fragments. Some soils at higher elevations have been moderately influenced by volcanic ash deposits.

Potential Natural Vegetation. Küchler mapped potential vegetation as Douglas-fir forest. The alpine treeline occurs at about 8,000 ft (2,420 m). Foothills prairie with wheatgrasses, fescues, and needlegrass occurs in the drier valleys. Principal tree species include Douglas-fir, hemlock, cedar, and grand fir.

Fauna. Birds are very similar to those in Section M333B, but with more high altitude species such as white-tailed ptarmigan, boreal owl, and American pipit. Birds of special note are the common loon, common and Barrow's goldeneyes, harlequin duck, varied thrush, Swainson's thrush, Townsend's warbler, and pine siskin.

Species nearing the edge of their range include chestnut-backed and boreal chickadees and northern waterthrush. Typical herbivores and carnivores include white-tailed deer, mule deer, elk, moose, black bear, bobcat, and cougar. Smaller common herbivores include the snowshoe hare and northern flying squirrel. Rare mammals include the grizzly bear, gray wolf, lynx, fisher, wolverine, and northern bog lemming. Herpetofauna typical of this Section are the spotted frog, Pacific treefrog, western toad, long-toed salamander, and possibly the Pacific giant salamander.

Climate. Precipitation ranges from 16 to over 100 in (410 to over 2,540 mm); most of the precipitation in fall, winter, and spring is snow. Climate is cool temperate with minor maritime influence; summers are dry. Temperature averages 36 to 46 °F (2 to 8 °C); arctic air intrusions occur during winter. The growing season ranges from 45 to 120 days.

Surface Water Characteristics. Abundant perennial streams occur, including the North and Middle Forks of the Flathead River. These drainages are moderately to deeply incised. Many lakes occur in glaciated terrain and at higher elevations, including Whitefish Lake and Lake McDonald.

Disturbance Regimes. Fire, insects, and disease are the principal natural sources of disturbance.

Land Use. Land use is dominated by wildlife habitat and recreation. Some timber harvest also occurs.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Section M333D–Bitterroot Mountains

Geomorphology. This area comprises steep dissected mountains, some with sharp crests and narrow valleys. Elevation ranges from 1,200 to 7,000 ft (366 to 2,135 m). This Section is within the Northern Rocky Mountains physiographic province.

Lithology and Stratigraphy. Predominant rocks are Precambrian metasedimentary of the Belt supergroup.

Soil Taxa. There are frigid and cryic Ochrepts and Boralfs, with some Udands and Cryands on areas where significant amounts of volcanic ash have been deposited. In general, many of the soils have been strongly influenced by deposits of volcanic ash which have made them productive. These soils are generally shallow to moderately deep with loamy to sandy textures.

Potential Natural Vegetation. Küchler classified potential vegetation as cedar-hemlock-pine forest, Douglas-fir forest, and western ponderosa forest. Common species include western red cedar, western hemlock, western white

pine, Douglas-fir, and ponderosa pine. Other important tree species include grand fir and mountain hemlock.

Fauna. Birds are typical of the northern Rocky Mountains, such as Steller's jay and pine siskin. Dabbling ducks, common goldeneye, and harlequin ducks also occur. Other species are flammulated owl, boreal owl in the higher elevations, Lewis' woodpecker, American dipper, pygmy nuthatch, Townsend's solitaire, and yellow-rumped, Nashville, and Townsend's warblers. White-headed woodpeckers reach the edge of their range in this Section. Typical herbivores and carnivores include white-tailed deer, mule deer, elk, moose, black bear, marten, bobcat, and cougar. The woodland caribou historically reached the southern extent of its range within this Section, but is now absent. Smaller common herbivores include the snowshoe hare and the northern flying squirrel. Rare mammals include the gray wolf, fisher, wolverine, northern bog lemming, and Coeur d' Alene salamander. Herpetofauna typical of this Section are the spotted frog, Pacific treefrog, western toad, long-toed salamander, and possibly the Pacific giant salamander.

Climate. Precipitation averages 40 to 80 in (1,020 to 2,030 mm); most precipitation in fall, winter, and spring

is snow; summers are relatively dry. Temperature averages 36 to 45 °F (2 to 7 °C). Climate is maritime-influenced, cool, moist temperate with relatively mild winters and dry summers. The growing season ranges from 45 to 100 days.

Surface Water Characteristics. Perennial streams are generally fairly steep and deeply incised, exhibiting much structural control. Major rivers include the Clark Fork and the North Fork of the Clearwater.

Disturbance Regimes. Fire, insects, and disease are the principal natural sources of disturbance. Mass wasting also occurs in some areas. Fires were mostly large, low frequency, high intensity, stand-replacing fires, except for the eastern quarter of the Section, which had mostly low intensity, frequent ground fires. Fire suppression efforts have altered the fire regime to a large extent.

Land Use. Timber harvest, wildlife habitat, and recreation are dominant land uses. Some grazing and mining also occur.

Cultural Ecology. Reserved.

Compiled by Northern Region.

Province M334–Black Hills Coniferous Forest

One Section has been delineated in this Province:
M334A–Black Hills. Located in Wyoming and South Dakota, it has an area of about 3,700 mi² (9,600 km²).

Section M334A–Black Hills

Geomorphology. Slopes range from moderate on some of the high plateaus to very steep along drainage ways and on peaks and ridges. Narrow valleys are mostly gently sloping to strongly sloping. Elevation ranges from 2,950 to 7,220 ft. (900 to 2,200 m). This Section is in the Great Plains geomorphic province.

Lithology and Stratigraphy. The central part of the Section is Precambrian granite and metamorphosed sedimentary and volcanic rocks. The periphery of the North Dakota area is Paleozoic carbonates and shales. Most of the Wyoming part is Cretaceous sandstones, siltstones, shales, and Tertiary intrusive igneous rocks.

Soil Taxa. There are mesic, frigid, and cryic temperature regimes. Soils include Alfisols, Inceptisols, and Entisols, including Orthents and Boralfs.

Potential Natural Vegetation. Küchler classified vegetation as Black Hills ponderosa pine forest.

Fauna. Typical large mammals of this Section are mule deer, white-tailed deer, elk, and mountain lion. Smaller

common mammals are jack rabbits, red foxes, swift foxes, porcupines, and bushy-tailed wood rats. Year-round forest dwelling bird species include the pygmy nuthatch, red-breasted nuthatch, black-capped chickadee, and Cooper's hawk. Summer residents include sharp-shinned hawk, belted kingfisher, chipping sparrow, and swallow. Representative herpetofauna are the prairie rattlesnake, wandering garter snake, snapping turtle, spiny softshell turtle, boreal chorus frog, and Great Plains toad.

Climate. Precipitation ranges from 15 to 26 in (370 to 650 mm). Temperature averages 37 to 48 °F (3 to 9 °C). The growing season 80 to 140 days.

Surface Water Characteristics. Perennial streams, springs, and shallow wells are present. Cold Brook Reservoir and Pactolo Reservoir are sizable man-made reservoirs in this area. Rivers include the Belle Fourche, Laramie, and the South Fork of the Powder.

Disturbance Regimes. Fire, insects, and disease are principal natural disturbances.

Land Use. Most of this area is national forest land. A small acreage is in small farms and ranches. Forestry, grazing, mining, and recreation are major land uses.

Cultural Ecology. Reserved.

Compiled by Rocky Mountain Region.



The Black Hills are characterized by dominant vegetation of open to dense ponderosa pine forests; the geology is varied.

Province 341–Intermountain Semi-Desert and Desert

Seven Sections have been delineated in this Province: 341A–Bonneville Basin; 341B–Northern Canyon Lands; 341C–Uinta Basin; 341D–Mono; 341E–Lahontan Basin; 341F–Southeastern Great Basin; and 341G–Northeastern Great Basin. These Sections are located in the west-central conterminous States, including parts of Nevada, Utah, and Colorado. The area of these Sections is about 107,100 mi² (277,400 km²).

Section 341A–Bonneville Basin

Geomorphology. This Section occurs within the Basin and Range physiographic province. Dominant landforms are north-south trending mountains separated by broad, sediment-filled valleys, many of which have internal drainages. Mountains were formed by faulting and were subsequently modified by erosion. Large alluvial fans have developed at the mouths of most canyons. Some fans are coalescing, nearly burying the eroded mountains. Playas are found in some closed basins, and salt flats are common. Elevation ranges from 4,000 to 8,000 ft (1,200 to 2,400 m).

Lithology and Stratigraphy. Miocene, Oligocene, and other undifferentiated Tertiary volcanic rocks dominate this Section. Rhyolites and basalts are also found. Sedimentary rocks from the Miocene-Pliocene epoch, sediments from the Pennsylvanian period, and limestone and dolomite from the Cambrian period also occur. Mud and salt flats are in the valleys near Great Salt Lake, along with Lake Bonneville deposits. Areas of Eolian deposits also occur. The southern portion of this Section has large areas of alluvium and colluvium.

Soil Taxa. Entisols and Aridisols occur in combination with mesic, frigid, and cryic soil temperature regimes, along with xeric and aridic soil moisture regimes. Large areas have saline-sodic affected soils.

Potential Natural Vegetation. Küchler vegetation types are saltbush-greasewood and juniper-pinyon woodlands. Areas of sagebrush and wheatgrass-grama-buffalograss also were mapped. The Soil Conservation Service identifies the potential natural vegetation as desert shrub, shrub-grass, and woodland vegetation.

Fauna. This Section evolved to sustain bison, antelope, desert bighorn sheep, and deer, and extensive populations of lagomorphs and sage grouse. Grizzly bear, wolf, cougar, and coyote were the major predators. Bison, grizzly bear, wolf, and bighorn sheep were extirpated. Recently, desert bighorn sheep were transplanted in the Deep Creek Mountain Range, and elk were transplanted in the Canyon Mountain Range. Presently, there is a thriving population of antelope, and a scattered population of mule deer on

mountain ranges. Cougar, coyotes, and bobcats have healthy numbers. There are extensive populations of black-tailed jackrabbits, desert cottontails, and pygmy cottontails. Isolated populations of sage grouse occur. The Section has also received transplants of non-native chukar and Hungarian partridge. There are many species of desert dwelling avifauna and scattered occurrences of reptiles. Historically, fish species included native fishes of Lake Bonneville, including least chub, Utah chub, speckled dace, Bonneville cutthroat trout, and Bonneville redbreasted shiner. Most of these species exist now only in isolated pockets and most are trending toward extirpation. They are being replaced by introduced species such as rainbow trout, largemouth bass, and mosquito fish.

Climate. Precipitation averages 4 to 10 in (100 to 250 mm) annually; mountains receive as much as 18 in, annually. Precipitation is very low from summer to mid-autumn. Summers are hot and dry with low humidity, and winters are cold and dry. Temperature averages 45 to 55 °F (7 to 13 °C). The growing season ranges from 60 to 150 days.

Surface Water Characteristics. Great Salt Lake and Utah Lake are the major features of this Section. The water from the Beaver and Sevier Rivers is used for irrigation and seldom reaches the Sevier Lake. Nonetheless, the Sevier River is the major drainage that ends at Sevier Lake. Small streams drain the mountain ranges, and all areas have internal drainage. Ground water is scarce and has poor quality because of salts. Major streams that flow from other Sections into this Section include the Weber, Bear, and Provo Rivers; they eventually enter the Great Salt Lake. Clear Lake and Fish Spring are important water fowl management areas.

Disturbance Regimes. Common low intensity short duration burns of sagebrush and desert shrubs occur during summer thunderstorms. Often there is insufficient understory to carry fires, or they are suppressed.

Land Use. Military use occurs for purposes such as testing nuclear and armed forces training. Livestock production is an important use of the area. Some mining has also occurred.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.

Section 341B–Northern Canyon Lands

Geomorphology. This area occurs within the Colorado Plateau physiographic province. Northern Canyon lands Section is located in the eastern portion of Utah. This

area is eroded by the Colorado River and its tributaries. Deep sheer-walled canyons, canyonlands, lines of cliffs, low plateaus, mesas, buttes, and badlands dominate the landscape. Major landforms are the San Rafael Swell, Henry Mountains, Abajo Mountains, La Sal Mountains, and Circle Cliffs. Elevation ranges from 4,200 to 12,700 ft (1,300 to 3,900 m).

Lithology and Stratigraphy. Types include shales from the Cretaceous period, sandstones near Arches National Park from the Jurassic period, shales and sandstones from the Triassic period, and sandstones near Natural Bridges National Monument from the Permian period. Some eolian deposits occur on the central portion of this Section. Inclusions of diorites in the lacolithic mountains are present.

Soil Taxa. Entisols and Aridisols occur in combination with mesic, frigid, and cryic soil temperature regimes, along with ustic and aridic soil moisture regimes. Some soils are saline-sodic affected. Areas of very sandy and shallow soils exist. Higher elevations have Mollisols, Alfisols, and Inceptisols.

Potential Natural Vegetation. Küchler vegetation types are blackbrush, juniper-pinyon woodlands, saltbush-greasewood, and galleta-three awn shrub steppe. Areas of ponderosa pine series occur on the La Sal and Abajo

Mountains. Areas of Arizona pine occur on the Henry Mountains. The Soil Conservation Service identifies the area as desert shrub and woodland vegetation with some big sagebrush. Spruce-fir forests with aspen occur on the higher elevations of the Henry, Abajo, and La Sal Mountains.

Fauna. This Section historically provided habitat for various species: desert bighorn sheep, bison, pronghorn antelope, and black-footed ferret in the lower elevations; mule deer, wild turkey, Rocky Mountain bighorn sheep, and elk at mid to high elevations; and river otter and beaver in riparian areas. These species, with the exception of pronghorn antelope and beaver, were extirpated through portions or all of the Section. Except the black-footed ferret, these extirpated species have been re-introduced. Large predators once included timber wolf, grizzly bear, black bear, cougar, bobcat, gray fox, and coyote. Timber wolf and grizzly bear have been extirpated. Wildlife species of the canyons include peregrine falcon, Mexican spotted owl, violet-green swallow, white-throated swift, woodrats (white-throated, bushy-tailed, and Mexican), ringtailed cat, spotted bat, rattlesnakes (midget-faded and Hopi), spadefoot toads (Great Basin and Mexican), collared lizard, and canyon tree frog. Desert shrub communities are characterized by prairie dogs (white-tailed and Gunnison), badger, kit fox, ferruginous hawk, turkey vulture, and burrowing owl.



Formations created by the erosional processes of wind and water are common in the Northern Canyon Lands Section.

Bald eagles winter in lower elevations and a very few remain to nest along river corridors. Jackrabbits (black-tailed and white-tailed), Ord's kangaroo rat, mountain and western bluebirds, loggerhead shrike, red-tailed hawk, and Brewer's sparrow typify species of sagebrush and grasslands. Pinyon mouse, cottontail rabbit, white-tailed antelope squirrel, pinyon jay, and short-horned lizard are common species of pinyon-juniper woodlands. Forested areas provide habitat for Williamson's sapsucker, band-tailed pigeon, three-toed woodpecker, olive-sided flycatcher, pygmy nuthatch, and tiger salamander. Boreal owls are suspected at higher elevations near treeline. Riparian areas are used by many bird species, including yellow-breasted chat, lazuli bunting, northern oriole, and the rare southwestern willow flycatcher. Native fish species include the rare Colorado squawfish, razorback sucker, bonytail chub, humpback chub, and Colorado cutthroat trout.

Climate. Precipitation ranges from 6 to 30 in (150 to 760 mm) annually; most occurs during spring and fall. The climate is very dry and hot in the summer with low humidity, and cold and dry in the winter, indicative of a desertic condition. Temperature averages 45 to 55 °F (8 to 13 °C); higher elevations are colder. The growing season ranges from 60 to 180 days.

Surface Water Characteristics. Water is scarce. The area is drained by the Colorado and Green Rivers and their tributaries. Ground water supplies are limited. Summer rainstorms cause flash flooding in much of the Section. Few lakes and reservoirs occur. A small portion of Lake Powell occurs in the Section.

Disturbance Regimes. Common, low intensity, short duration burns occur due to thunderstorms. Water and wind erosion is also occurring.

Land Use. Grazing for sheep and cattle is the major land use. Hay and pasture land occur to a very limited extent along drainage ways. Recreation is also an important use.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.

Section 341C–Uinta Basin

Geomorphology. This area occurs within the Colorado Plateau physiographic province. Uinta Basin Section lies south of the Uinta Mountain Range in northeastern Utah. It is a synclinal and topographical basin, with its east-west axis running near the south flank of the Uinta Mountains. The central portion is gently rolling with eroded slopes. Elevation ranges from 6,200 to 7,300 ft (1,900 to 2,200 m). Local relief ranges from 100 to 1,000 ft (30 to 300 m).

Lithology and Stratigraphy. Sedimentary rocks from the Cretaceous and Paleocene periods, dominantly shales,

sandstones, and siltstones, are dominant. Some glacial deposits occur on the northern portion of this Section. Alluvial and colluvial deposits occur in the center; some are old.

Soil Taxa. Entisols and Aridisols occur in combination with mesic and frigid soil temperature regimes, along with aridic soil moisture regimes. Many soils are saline-sodic affected.

Potential Natural Vegetation. Küchler vegetation types include juniper-pinyon woodlands and saltbush-greasewood. The Soil Conservation Service identifies some of the area as grasslands-shrub vegetation with some big sagebrush. Series include juniper-pinyon and saltbush-greasewood. Areas of big sagebush also occur.

Fauna. This Section is dominated by species typical of high, cold deserts. Mammals include white-tailed prairie dog, black-tailed jackrabbit, coyote, beaver, red fox, porcupine, spotted skunk, and Townsend's big-eared bat. It is year-round range for deer and antelope and winter range for elk. River otters were recently reintroduced, and their population appears to be increasing. Black-footed ferrets and bison occurred historically, but have been extirpated. Avifauna include waterfowl, wintering bald eagles, and an introduced population of Rio Grande turkeys along the Green River and its associated wetlands. Sandhill cranes and an occasional whooping crane occur during migration. The Green, White, and Duchense Rivers are thought to be important corridors for many neotropical migratory birds. The dominant desert shrub habitat is used by burrowing owls, short-eared owls, ferruginous hawks, sage sparrows, lark sparrows, western meadowlarks, loggerhead shrikes, horned larks, and occasional irruptions of lark buntings. Golden eagles nest throughout the Section. A breeding population of mountain plovers was recently documented here (representing an extension of their known range). Herpetofauna include the faded pygmy rattlesnake, striped whipsnake, and Woodhouse's toad. The Green River in this Section has been proposed as critical habitat for three endangered fishes endemic to the Colorado River system. Colorado squawfish, razorback sucker, and bonytail chub. It provides spawning habitat for the razorback sucker, and nursery habitat for all three species. The lower portions of the White River are also proposed critical habitat for the squawfish and razorback sucker. Two candidate fishes, flannelmouth sucker and roundtail chub, occur in the Green and White Rivers as well.

Climate. Precipitation averages 7 to 12 in (175 to 300 mm) annually; most occurs during spring and fall. It is very dry and hot in the summer with low humidity, and cold and dry in the winter, indicative of a desertic basin. Temperature averages 40 to 52 °F (4 to 11 °C). The growing season lasts 80 to 100 days

Surface Water Characteristics. Water is scarce. Some streams and rivers bring water into the area from adjoining mountains. Ground water supplies are limited. Major rivers that flow through the area are the Green,

Duchesne, Strawberry, and smaller creeks that drain into the Green. Few lakes and reservoirs occur; examples are the Strawberry reservoir, Starvation reservoir, and Steinaker reservoir.

Disturbance Regimes. Few low intensity short duration burns of sagebrush occur due to summer thunderstorms. Most disturbance is from wind and water erosion.

Land Use. Grazing for sheep and cattle is the major land use. Hay and pasture land also occur to a very limited extent along drainage ways.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.

Section 341D-Mono

Geomorphology. Isolated ranges of largely dissected block mountains are separated by aggraded desert plains (alluvial fans and basins). Elevation ranges from 4,000 to 14,200 ft (1,216 to 4,315 m). This Section is in the Basin and Range geomorphic province.

Lithology and Stratigraphy. Types include Cenozoic volcanic rocks and alluvial deposits, Paleozoic sedimentary and volcanic rocks, and Mesozoic granitic rocks.

Soil Taxa. Soils include Aridisols, Entisols, and Mollisols in combination with mesic, frigid, and cryic soil temperature regimes and xeric and aridic soil moisture regimes.

Potential Natural Vegetation. Küchler classified potential vegetation as sagebrush steppe, juniper-pinyon woodland, northern jeffrey pine forest, Great Basin subalpine forest, and alpine communities and barren. Potential natural communities include western juniper, pinyon pine, Jeffrey pine, basin sagebrush and bristlecone pine series.

Fauna. Pronghorn and mountain sheep were commonly found in the Section. Presently, pronghorn are limited to a few re-introduced herds and mountain sheep are found on a few high mountains. Mammals include mule deer, mountain lion, bobcat, coyote, jackrabbit, and chipmunk. Birds include eagles, hawks, northern goshawk, nighthawks, common poorwill, sage grouse, sparrows, and gnatcatchers. Mono Lake provides habitat to a wide variety of shore birds and migrating waterfowl. It is also the second-largest California gull rookery in the world. Sagebrush lizard, desert horned lizard, western fence lizard, and spadefoot toad are common.

Climate. Precipitation ranges from 10 to 25 in (250 to 640 mm). Temperature averages 39 to 50 °F (4 to 10 °C). The growing season ranges from 60 to 130 days.

Surface Water Characteristics: Few rapidly flowing rivers and streams occur. Rivers and streams flow in deeply incised canyons with bedrock controlled channels (higher elevations) to alluvial channels (lower elevations) that terminate in basins or lakes within the area, or in basins and lakes in the Mojave Desert, Bonneville Basin, or Northwestern Basin and Range Sections. Several large lakes occur within the Section.

Disturbance Regimes. Fires are infrequent, low, moderate, and high intensity surface or stand-replacing fires. This area contains locations with eruptive activity (lava flows and ash fall) within the past 200 years. This is a seismically active area with strong shaking and ground rupture.

Land Use. Composition and successional sequence of some communities have changed because of plant and animal species introduced between the mid 1800's and early 1900's related to mining, grazing, forestry, and recreational activities.

Cultural Ecology. Humans have been utilizing the Section for 10,000 years, and have been an integral part of its ecology for 3,000 to 5,000 years. Extensive prehistoric procurement and processing of obsidian resources have left vast areas pockmarked and littered with lithic debitage; extensive procurement and processing of piñon and pine nuts have modified vast areas of Jeffrey pine and pinyon. Historic mining booms beginning in the late 1800's and water diversion projects for the Los Angeles basin, beginning in the early 1900's, resulted in additional ecological modifications. Contemporary attitudes and beliefs emphasize amenity values. Human environment is characterized by a rural lifestyle of open space and outdoor leisure activity. Recreation is the primary economic emphasis, trailed by government employment, lumbering, mining, and grazing.

Compiled by Pacific Southwest Region.

Section 341E-Lahontan Basin

Geomorphology. This area occurs within the Great Basin physiographic province. Lahontan Basin Section is located in the western portion of Nevada. Block-faulting created upthrust north-south trending mountains which are interspersed with interior playas; surface water occurs frequently. Little glaciation is evident. Elevation ranges from 4,000 to 9,800 ft (1,200 to 3,000 m). Star Peak in the Humboldt Range is south of Winnemucca.

Lithology and Stratigraphy. Types include some Mesozoic granitics, but silicified sedimentary granitics predominate.

Soil Taxa. Soils include Mollisols, Vertisols, Entisols, Aridisols, Inceptisols, and Histosols. Mesic, frigid, and cryic soil temperature regimes predominate, along with torric, xeric, and aquic moisture regimes. Some saline-

sodic soils are present; many soils are typified by hard duripans in the profiles.

Potential Natural Vegetation. K chler vegetation types include saltbush-greasewood, big sagebrush, juniper-pinyon, aspen, marshes, and intermittent lakebeds with greasewood or little vegetation. The Soil Conservation Service identifies the vegetation as desert shrub with widespread shadscale. Areas of big sagebrush also occur.

Fauna. Camels, horses, and pronghorn antelope once characterized the Lahontan Basin Section. Today small herds of re-introduced antelope are found wintering in the lower elevations. Mule deer may be found in the pinyon-juniper and sagebrush zones. Coyote and bobcat are common. A variety of waterfowl use interior lakes. Wintering bald eagles are common on interior lakes. Avifauna is similar to what may be found in the sagebrush and pinyon-juniper zones in other parts of the Great Basin Province. Black-throated sparrow and sage sparrow typically inhabit the shadscale zone.

Climate. Precipitation averages 4 to 12 in (100 to 300 mm), increasing with elevation. It occurs primarily in the spring in the north and primarily in the winter in the south. The climate is very dry and hot in the summer with low humidity, and cold and dry in the winter, indicative of a desertic basin. Temperature averages 44 to 55  F (7 to 13  C). The growing season ranges from 80 to 152 days, decreasing with latitude.

Surface Water Characteristics. There are few perennial streams. Perennial waters consist primarily of the Humboldt River, headwaters of the Carson River, and interior lakes and marshes with no external drainage, typified by Humboldt Lake and Carson Sink. Occasional intense summer thunderstorms can produce massive runoff and flash flooding in the south end of this Section.

Disturbance Regimes. Fires are historically common due to thunderstorm activity. Large fires (1,000 acres or more) are common and moderately intense in the north end of this Section. Water and wind erosion also is occurring.

Land Use. Livestock production is the dominant land use, with some hay production in the major valley bottoms.

Compiled by Intermountain Region.

Section 341F–Southeastern Great Basin

Geomorphology. This area is within the Basin and Range physiographic province. The Southeastern Great Basin Section is located in southern Nevada. North-south trending mountains are separated by broad sediment-filled valleys. Mountains are formed by faulting and modified by erosion. Large alluvial fans are at the mouths of most canyons. Elevation ranges from 4,700 to 9,400 ft (1,425 to 2,900 m). There are three or four peaks southwest of the

Quinn-Canyon Range (in the Ely Ranger District of the Humboldt National Forest), which are at or close to 9,400 ft (2,900 m) elevation (e.g., Kawich Peak in the Kawich Range and Bald Peak in the Groom Range). These peaks are south and east of the southeastern-most end of the Toquima Range of the Toiyabe National Forest.

Lithology and Stratigraphy. Primary type is Lower Tertiary volcanic rock with Miocene volcanic rock. Valleys are filled with Quaternary deposits.

Soil Taxa. The dominant soils are Orthents, Psamments, Orthids, Argids, and Xerolls with mesic or frigid temperature regime, depending mostly on elevation. Some Aquolls occur in valley bottoms. Torriorthents and Torripsamments are on recent alluvial landforms. There are shallow to deep Camborthids, Durorthids, Nadurargids, Natrargids, Calciorthids, and Torriorthents, and shallow to deep Durixerolls, Haploxerolls, and Argixerolls in the mountains.

Potential Natural Vegetation. K chler vegetation types include Great Basin sagebrush with some Great Basin pine forest and saltbush-greasewood. The Soil Conservation Service has classified the area as being desert-shrub, shrub-grass, and woodland vegetation. This area is a transitional zone between the mountains of the Toquima–Grant–Quinn Ranges, and the true Mojave (represented by Joshua tree cactus). Site factors (precipitation, soils, and topography) influence distribution of cholla chactus, greasewood and saltbush species, ephedra, sagebrush species, galleta grass, banana yucca, Fremont barberry, little leaf mahogany, Utah juniper, and single leaf pinyon; small amounts of limber pine, ponderosa pine, bristlecone pine, and subalpine fir.

Fauna. A variety of endemic fishes occur, including White River springfish, Railroad Valley springfish, White River mountainsucker, White River spinedace, Pahrnagat spinedace, White River Colorado gila, and White River speckled dace. The Big Spring spinedace which once occurred here is now extinct. Desert bighorn sheep and pronghorn antelope live here. Nevada ring-tailed cats and two subspecies of kit fox live in the lowlands. Pallid bats, California myotis, western pipistrelle, and Mexican free-tailed bats range through the Section. Bailey’s bobcat inhabits this Section, along with a variety of small mammals. round-tailed ground squirrel, cliff and Say chipmunks, Mohave long-tailed pocket mouse, Virgin River little pocket mouse, pallid kangaroo mouse, Merriam’s and desert kangaroo rats, long-tailed southern grasshopper mouse, Stephen’s canyon mouse, and the Arizona Audubon cottontail.

Climate. Precipitation ranges from 3 in (76 mm) at lowest elevations to over 20 in (510 mm) in the highest mountain ranges. Precipitation occurs mostly in winter months. Average annual temperature ranges from 52 to 60  F (11 to 15  C). The growing season ranges from 60 to 200 days, decreasing with elevation.

Surface Water Characteristics. There is very little perennial surface water. The headwaters of the White River (a tributary of the Colorado) are contained within this Section. Most other surface waters are intermittent, with internal drainage.

Disturbance Regimes. Infrequent, small to moderate, low intensity fires start due to thunderstorms. Fires remain small due to sparse fuels. Erosion by wind and water occur.

Land Use. Training and testing for the military and nuclear testing occur. Livestock production also occurs in this Section, along with some mining.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.

Section 341G—Northeastern Great Basin

Geomorphology. This area occurs within the Basin and Range physiographic province. The Northeastern Great Basin Section is located in northeastern Nevada. There are north-south trending mountains with broad sediment-filled valleys, formed by thrust-faulting (e.g., south Independence Range). Some glaciation is evident on the highest peaks. Elevation ranges from 4,800 to 10,704 ft (1,500 to 3,250 m).

Lithology and Stratigraphy. Types include Mississippian, Ordovician, and Silurian quartzite, dolomite, chert, and Ordovician argillite and shale; and Devonian siltstones also occur.

Soil Taxa. Soils include Mollisols, Inceptisols, Entisols, Inceptisols, and Aridisols, along with a few Histosols. There are also Borolls, Xerolls, Fluvents, Orthents, Ochrepts, Umbrepts, Aquepts, Aquolls, Fibrists, Hemists, Saprists, and Aquepts. These are identified through work done in the south Independence Range and the east

Humboldt Range. These soils are associated with aridic and xeric moisture regimes, and mesic, frigid, and cryic temperature regimes.

Potential Natural Vegetation. Kuchler vegetation types include Great Basin sagebrush and juniper-pinyon woodlands. Juniper-mahogany woodlands and aspen are also found.

Fauna. Small bands of bison once used the lowlands along the main river systems, but disappeared prior to white settlement. Marsh and riparian areas support rare Preble's shrews and a variety of shore birds and marsh-dwellers, including bobolinks. Lahontan cutthroat range into upper waters of this Section from mountain headwaters upstream, while the Lahontan redbelly shiner occurs throughout the Section. Endemic freshwater clams are found in the upper Humboldt River system. Richardson's ground squirrels and Nevada jumping mice are common.

Climate. Precipitation ranges from 8 to 30 in (200 to 760 mm), increasing with elevation. Average annual temperature ranges from 39 to 50 °F (4 to 10 °C). The growing season lasts from 50 to 125 days, decreasing with elevation.

Surface Water Characteristics. There are moderate to steep gradient perennial and intermittent streams, plus narrow flood plains. Some developed impoundments and a few cirque lakes are present. Many streams are diverted out of channel for irrigation.

Disturbance Regimes. Infrequent, moderate to large sized fires occur due to summer thunderstorms. Periodic catastrophic snowmelt in high snow years leads to debris flows down steep mountain valleys.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.

Province 342–Intermountain Semi-Desert

Nine Sections have been delineated in this Province: 342A–Bighorn Basin; 342B–Northwestern Basin and Range; 342C–Owyhee Uplands; 342D–Snake River Basalts; 342E–Bear Lake; 342F–Central Basin and Hills; 342G–Green River Basin; 342H–High Lava Plains; and 342I–Columbia Basin. These Sections are located in the northwestern conterminous States, including parts of Washington, Oregon, California, Nevada, Idaho, Utah, Wyoming, and Colorado. The area of these Sections is about 159,100 mi² (412,100 km²).

Section 342A–Bighorn Basin

Geomorphology. There are piedmont plains and mountain footslopes with large stream terraces along the Wind-Bighorn River system. Plains are eroded to clay shale bedrock in some places, forming badlands. Elevation ranges from 3,600 to 5,900 ft (1,100 to 1,800 m). This Section is within the Middle Rocky Mountains physiographic province.

Lithology and Stratigraphy. Oligocene, Eocene, and Paleocene sedimentary rocks overlie Precambrian rocks.

Soil Taxa. Types include mesic Argids, Orthids, and Orthents. These soils are generally moderately deep to deep with moderately fine to clayey textures.

Potential Natural Vegetation. Küchler classified potential vegetation as saltbush-greasewood, wheatgrass-needlegrass-shrubsteppe, and sagebrush steppe. Common species include big sagebrush, gardner saltbush, indian ricegrass, and needleandthread. Black sage and bluebunch wheatgrass are common on areas with shallow soils.

Fauna. Birds are typical of the middle Rocky Mountains, and are very similar to those that occur in Sections M331A and M331B. Other species of note are the ferruginous hawk, golden eagle, sage grouse, burrowing owl, Say's phoebe, sage thrasher, and pygmy nuthatch. Eastern kingbirds near the edge of their range in this Section. Typical herbivores and carnivores include white-tailed deer, mule deer, pronghorn, bobcat, and cougar. Smaller common herbivores are the white-tailed jackrabbit, white-tailed prairie dog, and black-tailed prairie dog. Less common is the black-tailed jackrabbit. The bison and black-footed ferret are historically associated with this Section. Herpetofauna typical of this Section are the Great Plains toad, snapping turtle, spiny softshell turtle, smooth green snake, and prairie rattlesnake.

Climate. Precipitation averages 5 to 9 in. (120 to 230 mm). Temperature averages 45 °F (7 °C). The growing season lasts 120 to 140 days.

Surface Water Characteristics. There are moderate to deeply incised third to fifth order streams with dendritic drainage patterns. Major rivers include the Wind, Bighorn, Greybull, and Shoshone. Deep artesian wells also occur.

Disturbance Regimes. Fire and drought are the principal natural sources of disturbance.

Land Use. The dominant land use is livestock grazing. About 5 percent of the area is irrigated.

Cultural Ecology. Reserved.

Compiled by Northern Region and Rocky Mountain Region.

Section 342B–Northwestern Basin and Range

Geomorphology. This area occurs within the Basin and Range physiographic province. Northwestern Basin and Range Section is located in the northern portion of Nevada, southeastern Idaho, and south-central Oregon. It extends into northern Utah also. Nearly level basins and valleys are bordered by long, gently sloping alluvial fans. North-south trending mountain ranges and few volcanic plateaus rise sharply above the valleys. Large alluvial fans have developed at the mouths of most canyons. Elevation ranges from 4,000 to 7,200 ft (1,200 to 2,200 m).

Lithology and Stratigraphy. Pliocene volcanic and shallow intrusive igneous rocks occur, along with andesite, breccias, and basalt flows. Alluvial deposits, playas, marshes, and flat deposits occur in the valleys.

Soil Taxa. There are Aridisols in combination with frigid and mesic soil temperature regimes, along with xeric and aridic soil moisture regimes. Large areas have saline-sodic affected soils.

Potential Natural Vegetation. Küchler vegetation types include sagebrush steppe. The Soil Conservation Service identifies the potential natural vegetation as shrub-grass with saltbush-greasewood vegetation.

Fauna. A major migration route for waterfowl crosses this Section. It is characterized particularly by tundra swans, lesser snow geese, American widgeons, and pintail, canvasback, and ruddy ducks, which use the wetlands around interior basin lakes. Sandhill cranes, western snowy plovers, and white-faced ibis nest here. California bighorn sheep and California quail characterize the uplands. Small bands of bison once roamed the margin of Malheur Lake but disappeared prior to white settlement. Rare kit foxes live in the desert lowlands. Pronghorn

and mule deer are present. Wolverines are occasionally found. Gray flycatchers, Townsend's solitaires, northern sage sparrows, and broad-tailed hummingbirds are characteristic. Spotted frogs and Malheur shrews are uncommon riparian species. Antelope ground squirrels occupy areas of pale desert soils. Sharptail grouse, once common, are no longer present. Warner Lake suckers, Alvord chubs, and Soldier Meadows desertfish are endemic fishes of interior basin lakes and springs. Lahontan cutthroat trout also characterize this Section.

Climate. Precipitation ranges from 4 to 20 in (100 to 790 mm) annually; mountains receive as much as 20 in annually. Precipitation is evenly distributed throughout fall, winter, and spring, but is low in the summer. Summers are hot and dry and winters are cold and dry. Temperature averages 41 to 50 °F (5 to 10 °C). The growing season ranges from 30 to 140 days.

Surface Water Characteristics. Water is scarce except at higher elevations. Few streams and little water storage occurs in this Section. Large ground water supplies have been untapped. Pyramid Lake is the major lake in this Section.

Disturbance Regimes. Short duration and low intensity brush fires occur due to summer thunderstorms. Water and wind erosion is also occurring.

Land Use. Livestock production is the primary use, with little farming. Some mining has also occurred.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.

Section 342C—Owyhee Uplands

Geomorphology. This area occurs within the Columbia Plateau physiographic province, also known as the Columbia Intermontane province. The Owyhee Uplands Section is part of southwest Idaho, southeast Oregon, and northern Nevada. This area is an uplifted region with doming and block-faulting common. It is deeply dissected from erosional processes. Lavas are older than that of the Snake River Plains. The Owyhee Mountains are made of granite; however, most of the uplands are rhyolites and welded tuffs with silicic volcanic flows, ash deposits, and wind-blown loess. Elevation ranges from 4,000 to 8,000 ft (1,200 to 2,500 m).

Lithology and Stratigraphy. Miocene basalt rocks occur here. Rhyolites, welded tuffs, and silicic volcanic flows are also found in this Section. Columbia basalts occur along the Snake River.

Soil Taxa. Aridisols, Entisols, Alfisols, Inceptisols, and Mollisols occur in combination with mesic and frigid soil temperature regimes, and xeric and aridic soil moisture regimes. Cryic temperature regimes occur at higher elevations.

Potential Natural Vegetation. Küchler vegetation types are sagebrush steppe with *Artemisia* and *Agropyron* and small areas of wheatgrass-bluegrass. The Soil Conservation Service identifies the area as having a sagebrush-grass potential natural vegetation.

Fauna. A major migration route for geese crosses this Section, and it is used particularly by the intermountain population of Canada geese. This Section also is a major wintering area for mallards and common mergansers. California bighorn sheep live in rocky canyons. Gray flycatchers, northern sage sparrows, and mountain quail live in the sagebrush and juniper uplands. Wolverine once lived here but have not been seen for decades. Once common, sharptail grouse are scarce in grasslands and sagebrush foothills. Spotted frogs have been found here. Small bands of elk roam the uplands year-round, and elk from surrounding Sections winter here. Pronghorn, mule deer, and sage grouse inhabit this Section. Remnant bull trout populations are found in cold headwater streams. Other Columbia and Snake River system species include northern squawfish, biglip sucker, bridgelip sucker, Utah sucker, and Columbia redbreast shiners.

Climate. Precipitation ranges from 7 to 15 in (200 to 400 mm) annually; it is close to evenly distributed throughout the year, but is low from mid summer to early autumn. Precipitation is only 20 percent of the evaporation potential during the frost-free period. Summers are dry with low humidity. Temperature averages 35 to 45 °F (2 to 8 °C). The growing season ranges from 90 to 120 days but is less than 60 days at higher elevations.

Surface Water Characteristics. Water supply from precipitation and streamflow is small and unreliable, except along the Owyhee, Bruneau, and Humboldt Rivers. Snow accumulation at the higher elevations contributes to streamflow. Few small lakes and reservoirs are found in this Section.

Disturbance Regimes. After fire, grasses and forbs replace higher seral species. Water and wind erosion is also occurring.

Land use. Livestock grazing, and dryland and irrigated farming are the major land uses. Recreation is also important.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.

Section 342D—Snake River Basalts

Geomorphology. This area occurs within the Columbia Plateau physiographic province, also known as the Columbia Intermontane province. The Snake River Basalts Section is part of southeast and south-central Idaho. Most of this Section is characterized by nearly horizontal sheets of basalt laid down in the Snake River

drainage to form a plain. Lava flows range from less than 100 ft thick to several thousand ft thick. Block-faulted mountains are also included in this Section. The basalts are mainly two ages: the older flows are of the Miocene and Pliocene epoch; the younger lavas are Pliocene through Recent. The Section is about 60 mi wide and is essentially flat; however, the eastern portions of the Section are much higher in elevation. The surface is a youthful lava plateau with a thin wind-blown soil layer covering it. Shield volcanoes, cinder cones, and squeezed-up lava ridges are common. Craters of the Moon National Monument is an example of the recent volcanic features. Elevation ranges from 3,000 to 6,000 ft (900 to 2,000 m). Lava plain and hills are nearly level to steeply sloping.

Lithology and Stratigraphy. Miocene and Pliocene basalt rocks are present. Sedimentary rocks interbedded with older basalt flows are in the western portion of the Section.

Soil Taxa. Aridisols, Entisols, and Mollisols occur in combination with mesic and frigid soil temperature regimes, along with xeric and aridic soil moisture regimes.

Potential Natural Vegetation. Küchler vegetation types include sagebrush steppe with *Artemisia* and *Agropyron*. The Soil Conservation Service identifies the area as having a sagebrush-grass potential natural vegetation.

Fauna. This Section was once characterized by bison and bighorn sheep, and large carnivores such as the grizzly bear and gray wolf. These species have been reduced, primarily at the hand of man, to isolated areas within their historic range. Currently, large ungulates include Rocky Mountain elk, mule deer, and pronghorn. Cougar, bobcat, black bear and coyote constitute a portion of the predator component. Historical and present-day herpetofauna include the western toad, Great Basin spadefoot; short-horned and sagebrush lizards; and the gopher snake, rubber boa, racer, and several species of garter snakes. Habitats in this Section support a rich and diverse avifauna of neotropical migratory land birds, waterfowl, and gallinaceous species. Three mammalian species, the yellow pine chipmunk, Great Basin pocket mouse, and the dark phase pika, are endemic to this Section. Lava tubes provide roosting, hibernacula, and nursery habitat for several species of bats. Salmonid species include rainbow, brown, and brook, as well as hybrid trout.

Climate. Precipitation ranges from 5 to 12 in (127 to 305 mm) annually; it is evenly distributed throughout the fall, winter, and spring, but is low in the summer. Precipitation is only 20 percent of the evaporation potential during the frost-free period. Summers are dry with low humidity. Temperature averages 40 to 58 °F (4 to 13 °C). The growing season ranges from 60 to 165 days, decreasing from west to east and with elevation.

Surface Water Characteristics. Low to moderate precipitation provides enough water for dry farming

on the outer foothills. Rivers and streams flow into the Snake River drainage. Few lakes and reservoirs are located in this Section. Large lakes and reservoirs include American Falls reservoir, Mud Lake, and Lake Walcott.

Disturbance Regimes. After fire, grasses and forbs replace higher seral species. Water and wind erosion is also occurring.

Land use. Livestock grazing and dryland and irrigated farming are the major land uses. Recreation is also important.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.

Section 342E–Bear Lake

Geomorphology. This area occurs within the Middle Rocky Mountain physiographic province. The Bear Lake Section is located in the southeast corner of Idaho, southwest corner of Wyoming, and northern corner of Utah. Steep north-south oriented mountain ranges with broad linear valleys are the major landforms. Few areas have been glaciated and were mostly formed from thrust and faults, landslides, and pluvial action.

Lithology and Stratigraphy. There are Eocene continental deposits, mostly sedimentary rocks. Some Eocene lacustrine deposits occur in Wyoming.

Soil Taxa. Alfisols, Mollisols, Histisols, Inceptisols, and Entisols occur in combination with frigid and cryic soil temperature regimes, along with xeric, udic, and aquic soil moisture regimes.

Potential Natural Vegetation. Küchler vegetation types include lodgepole pine and Douglas-fir forests, with outer fringes of sagebrush lands. Oak-pine forests occur in the Utah portion of this Section. The Soil Conservation Service identifies the potential natural vegetation as mixed conifers and sagebrush-grassland with Douglas-fir, lodgepole pine, and aspen occupying northern aspects.

Fauna. This Section was once characterized by bison, elk, deer, and pronghorn, with carnivores such as grizzly bear, gray wolf, coyote, and mountain lion. These species have been reduced, primarily due to man. The grizzly bear and gray wolf have been extirpated from the area. Currently, large ungulates include elk, deer, pronghorn, and moose. Coyote, fox, mountain lion, and some black bear make up the main predator species. Historical and present herpetofauna include western rattlesnake, garter snake, leopard frog, chorus frog, and short horned and sagebrush lizards. Habitats in this Section support many neotropical migratory land birds, waterfowl, raptor, and gallinaceous species. Bonneville cutthroat trout represent the historic salmonids and may exist in isolated areas today. Other aquatic species include brown, brook, and rainbow trout.

Climate. Precipitation ranges from 16 to 40 in (400 to 1,000 mm) annually; most occurs during fall, winter and spring. Precipitation occurs mostly as snow above 6,000 ft (1,800 m). Rain on snow is common. Summers are dry with low humidity. Winter precipitation patterns account for large snow accumulations. Temperature averages 34 to 48 °F (1 to 9°C). The growing season ranges from 50 to 180 days.

Surface Water Characteristics. There is a low to moderate frequency of rapidly flowing rivers and streams. Rivers flow into the Great Basin or Snake River drainage. A small area of the Section is drained by the Colorado River. Few lakes and wet meadows are associated with higher areas above 5,000 ft (1,500 m). Large lakes include Bear Lake, Gray's Lake, Palisades Reservoir, and Blackfoot Reservoir.

Disturbance Regimes. A few high intensity, short duration burns of shrubs occur in the summer due to thunderstorms. Water and wind erosion occurs.

Land Use. Grazing is the major land use, with agricultural crop production also being important. Watershed and recreation are also an significant uses.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.

Section 342F—Central Basins and Hills

Geomorphology. Plains eroded to clay shale bedrock, creating badlands. Mountain ranges include steep slopes that rise sharply from desert basins. There are alluvial fans, piedmont plains, and piedmonts that slope from the mountains to stream terraces of the Wind-Bighorn system, and to broad intermountain basins. Rugged hills and low mountains are cut by narrow valleys with steep gradients. Broad flood plains are associated with some of the major rivers. Elevation ranges from 3,610 to 10,170 ft (1,100 to 3,100 m). This Section is within Fenneman and Johnson's Wyoming Basin geomorphic physical division.

Lithology and Stratigraphy. The northern half of the Section is Tertiary sandstones, siltstones, and shales. The southern half of the Section is Cretaceous through Tertiary sandstones, siltstones, shales, conglomerates, and local coals. The middle part of the Section also includes local Precambrian granite and metamorphosed sedimentary and volcanic rocks and Precambrian granite and Paleozoic carbonates in the Seminole Mountains.

Soil Taxa. There are mesic and frigid temperature regimes. Soils include Mollisols, Inceptisols, Aridisols, and Entisols, including, Argids, Orthents, Borolls, and Fluvents.



Central Basin and Hills Section.

Potential Natural Vegetation. Vegetative communities range from grass to grass-shrub to shrub-grass to forest. Küchler mapped vegetation as sagebrush steppe (sagebrush-wheatgrass); wheatgrass-needlegrass shrub steppe; grama-needlegrass-wheatgrass prairie; and Douglas-fir forests.

Fauna. Typical large mammals of this Section are mule deer, white-tailed deer, elk, and mountain lion. Smaller common mammals are jackrabbit, red fox, swift fox, porcupine, and bushy-tailed wood rat. Year-round forest dwelling bird species include the pygmy nuthatch, red-breasted nuthatch, black-capped chickadee, and Cooper's hawk. Summer residents include sharp-shinned hawk, belted kingfisher, chipping sparrow, and swallow. Representative herpetofauna are the prairie rattlesnake, wandering garter snake, snapping turtle, spiny softshell turtle, boreal chorus frog, and Great Plains toad.

Climate. Precipitation ranges from 5 to 30 in (120 to 750 mm). Temperature averages 39 to 52 °F (4 to 11 °C). The growing season ranges from 80 to 140 days.

Surface Water Characteristics. Water is scarce in some areas. The Wind, Bighorn, South Fork of the Powder, Little Medicine Bow, North Platte, Laramie, and Sweetwater Rivers flow through here. Deep artesian wells exist in the eastern Bighorn basin. Small and intermittent streamflow occurs in some areas. Ground water is meager or lacking in most areas, but is abundant in the fill in some of the valleys of the northern foothills.

Disturbance Regimes. Fire, insects, and disease are primary sources of disturbance.

Land Use. About 50 percent of this area is Federally owned, and 50 percent is in farms and ranches. Most of the land is used for sheep and cattle grazing. About 5 percent of the area is irrigated; often these are small tracts in isolated valleys or along major streams. Some open woodlands at high elevations support logging activities. About 20 percent of the area is in dry crops.

Cultural Ecology. Reserved.

Compiled by Rocky Mountain Region.

Section 342G—Green River Basin

Geomorphology. This Section includes rugged hills and low mountains, with narrow valleys having steep gradients. Broad flood plains and fans are present on major rivers. Alluvial fans, piedmont plains, and piedmont slopes from the surrounding mountains join to form broad intermountain basins. Elevation ranges from 3,610 to 7,875 ft (1,100 to 2,400 m). This Section is within Fenneman and Johnson's Wyoming Basin geomorphic physical division.

Lithology and Stratigraphy. Most of the Section is Tertiary conglomerates, sandstones, siltstones, and shales, with local Quaternary dune sands and loess. In the eastern quarter of the Section on the Rock Springs uplift, there are Cretaceous sandstones, siltstones, conglomerates, shales, and local coals.

Soil Taxa. The temperature regime is frigid. Soils include Mollisols, Aridisols, and Entisols, including Borolls, Orthents, Fluvents, and Argids.



Northern part of Green River Basin, with low hills in background.

Potential Natural Vegetation. Vegetative communities include grasses to grass-shrub to forests. Küchler classified potential vegetation as sagebrush steppe (sagebrush-wheatgrass), saltbush-greasewood, and wheatgrass-needlegrass shrubsteppe.

Fauna. Pronghorn use parts of the sagebrush ecosystem as rangeland throughout the year. Mule deer prefer to use sagebrush rangeland only during the winter. The Utah prairie dog is an endangered species of this ecosystem. Other mammals that use this ecosystem are the Great Basin coyote, black-tailed jackrabbit, pygmy cottontail, Ord's kangaroo rat, and the Great Basin kangaroo rat. Bird populations are low during the breeding season, averaging only about 25 per 100 acres. The major birds include the marsh hawk, red-tailed hawk, Swainson's hawk, Cooper's hawk, golden eagle, bald eagle, prairie falcon, burrowing owl, and the long-eared owl. The sage grouse and chukar are the important game birds found in this ecosystem. The fauna that are found in the desert shrub ecosystem (saltbush-greasewood community) are the cactus mouse, long-tailed pocket mouse, desert kangaroo rat, black-tailed jackrabbit, and the antelope ground squirrel.

Climate. Precipitation ranges from 7 to 20 in (150 to 500 mm). Temperature averages 39 to 52 °F (4 to 11 °C). The growing season ranges from 80 to 125 days.

Surface Water Characteristics. Water is scarce, but some major rivers and small streams flow through here. Generally, ground water is meager or lacking in most areas, but it is abundant in the fill in some valleys. The Green and Lower Snake Rivers flow through here. Part of the Flaming Gorge Reservoir lies in this Section.

Disturbance Regimes. Primary sources of disturbance are fire, insects and disease.

Land Use. About 80 percent of the area is in farms or ranches. About 50 percent of the area is grazed by sheep and cattle. Many of the valleys and tracts along a few large streams are irrigated, but they make up only 1 to 5 percent of the total area. About 20 percent of the area is dry farmed.

Cultural Ecology. Reserved.

Compiled by Rocky Mountain Region.

Section 342H-High Lava Plains

Geomorphology. This area includes moderately dissected mountains and broad flat uplands. This Section is dominated by debris slides, rock fall and slow creep erosion processes on slopes of 20 to 120 percent. Some ancient lake terraces occur along the valley sides on slopes less than 30 percent. A multitude of young eruptive events have left volcanic features. During glacial stages numerous large lakes formed, filling to the playas found today. Elevation ranges from 2,000 to 5,000 ft (700 to 1,700 m). Local relief is mostly 300 to 800 ft (90 to 242 m).

Lithology and Stratigraphy. There are Eocene, Oligocene, and Miocene basalts with minor tuffs, sandstone, and siltstone. The Section is predominately underlain by a Columbia River basalt group equivalent. Extensive playas are filled in with fluvial sediments and volcanic ash.



Western juniper-sagebrush-grass communities on moderately deep xeric Mollisols underlain by Columbia River Basalts.

Soil Taxa. Soils in this Section are warm (mesic soil temperature regime) and dry (aridic and xeric soil moisture regimes). They vary in depth to the underlying bedrock and the influence of volcanic ash. In the southern part, there are soils with thin, dark topsoil (Xerollic Camborthids), and some with volcanic ash (Vitrixerandic Camborthids). Other soils with thin, dark topsoil have a cemented hardpan that impedes roots, and a clay-enriched subsoil without volcanic ash (Xerollic Durargids) or with volcanic ash (Vitrixerandic Durargids). Shallow, sandy soils (Lithic Torripsamments) also occur in this part. In other parts of this Section, most soils have thick, dark topsoil and clay-enriched subsoil (Lithic, Aridic and Aridic Calcic Argixerolls, and Aridic Palexerolls); some of these soils also contain volcanic glass (Vitritorrandic Argixerolls).

Potential Natural Vegetation. Kuchler vegetation is characterized by three principal groups. Sagebrush-steppe (*Artemesia-Agropyron*) is considered dominant; followed by the juniper-steppe woodland (*Juniperus-Artemesia-Agropyron*) type; least common is wheatgrass-bluegrass (*Agropyron-Poa*). More recent classifications reveal a somewhat different characterization. A savanna with ponderosa pine occurs along the extreme western edge of this Section. Proceeding east, western juniper forms a woodland mixed with native sagebrush, bitterbrush and bunchgrasses. This woodland dominates the landscape over much of the western one-third of the Section. The woodland character soon changes as one proceeds east, with sagebrush and bunchgrasses dominating the undulating land; western juniper becomes restricted to rocky outcrops and other areas that have not experienced a recent fire. The eastern portion of the Section maintains a vegetative dominance of sagebrush and bunchgrass, but elements of either the desert or salt desert shrub communities are noticeable. Locally, grasses, sedges, rushes, and forbs occupy wet sites in meadows and along streams.

Fauna. Mule deer and antelope typify the herbivorous component of this Section. Rocky Mountain elk, a recent invader, is now found in the Section in sustained isolated populations. Sage grouse, once common, is now restricted from its original distribution. Valley quail and chukar, introduced species, are found in sustained huntable populations. The Rio Grande turkey, very recently introduced, is now common in isolated populations. Prairie falcon, black-tailed jackrabbit, marmot, badger, and ground squirrel are common small mammals. Magpie, raven, golden eagle, and goshawk are common members of the avian component. Pocket gopher is a common fossorial mammal.

Climate. Precipitation averages 7 to 14 in (180 to 360 mm). Average annual air temperature is 40 to 57 °F (4 to 13 °C). The growing season ranges from 50 to 200 days

Surface Water Characteristics. Streams are infrequent and many are intermittent. Occasional wet meadows, springs, and seeps occur.

Disturbance Regimes. Prior to fire protection, fire was a common disturbance factor. Periods were about 15 to 30 years.

Land Use. Land use is dominantly ranching, including grazing of domestic livestock; other uses include irrigated agriculture, dispersed recreation, and rural communities.

Cultural Ecology. Humans have occupied the Blue Mountains and High Lava Plains Section for at least 12,000 years. This region exhibited prehistoric lifestyles that were transitional between Great Basin cultural patterns to the south and Columbia Plateau cultural patterns to the north. Root digging, seed and berry gathering, hunting, and fishing were the primary economic activities; their relative importance shifted with changing

climatic conditions. Peoples tended to live in groups comprising a couple of families during much of the year to utilize resources that were scattered over the landscape and which ripened at different times. Several such groups would come together seasonally at camps on rivers, streams, or large upland meadows to exploit concentrated resources and utilize stored resources. Burning was practiced to improve the production of berries, big game forage, and to drive game. Extensive deposits of obsidian and basalt were intensively used, and these materials were re-distributed widely. Euro-American settlement and exploitation of the area began in the mid 1800's and intensified during the 1860's with the discovery of gold. Locally heavy alteration to the landscape and hydrology occurred due to hydraulic mining and attendant ditch building and use; later these operations were followed by hardrock mining and dredging. Mineral extraction and activities related to improved transportation systems and agriculture led to relatively large settled human populations. Logging, railroad construction, cattle and sheep grazing, and fire suppression have also played a significant role in alteration of the environment. Historic uses of the land created ecological effects on plant and animal species and other resources that far exceed those from prehistoric times.

Compiled by Pacific Northwest Region.

Section 342I—Columbia Basin

Geomorphology. The Section is characterized by generally flat-lying basalt flows. It is a large dissected plain high above sea level. Structurally the Plateau is a great basin between the Rockies and the Cascades. Also, it is the best known example of plateau flood basalts. Channeled scablands, the result of mega-floods, range from excavated low points to coulees miles wide and hundreds of ft deep. Deposits of glacial till, glacial moraine, or glacial outwash blanket the plain. Rolling hills of loess cover unglaciated areas to the south and east. Elevation ranges from less than 200 ft near the Columbia River to more than 4,500 ft on high ridges and low mountains (70 to 1,500 m).

Lithology and Stratigraphy. There are extensive cyclic Miocene basalt deposits, with layers ranging generally from a few dozen to a hundred ft thick. The entire deposit may total over 15,000 ft (4,545 m) deep. Interflow baked soil horizons are common and may reach 5 ft (1.5 m) thick. Older buried rocks include Precambrian marine sediments, Permian through Jurassic marine sediments, and submarine volcanics and Cretaceous granites. Glacial floods during the Pleistocene deeply eroded the basalt plateau, leaving giant gravel bars, alluvial aprons, and ephemeral lake deposits. Where not removed by floods, loess may overlie basalts from 0 to 200 ft (0 to 60 m) thick.

Soil Taxa. In this Section, soils are mostly warm (mesic soil temperature regime) and dry (aridic soil moisture regime). They formed in parent materials resulting from

erosion and re-deposition by great floods and strong winds across the relatively level lava plateau. Volcanic ash deposited in this area has been mostly eroded and mixed with other material, thereby removing and diluting the ash influence in soils. Loess of varying thickness blankets most of this Section. In the central part, there are soils formed in eolium ranging from coarse to silty and in sandy eolium. They overlie sandy glaciolacustrine materials (Xeric Torripsamments and Xeric Torriorthents). These eolium soils also overlie very gravelly and cobbly glaciofluvial materials or fine-textured slack water deposits (Xerollic Camborthids, Aridic and Calciorthidic Haploxerolls).

In the northeastern part, loess hills are dissected by channeled scablands. Soils on the loess hills formed in mostly deep coarse-textured loess (Xerollic Camborthids), some with dark topsoil and lime-enriched subsoil (Calciorthidic Haploxerolls), and with clay-enriched subsoils (Aridic Calcic Argixerolls). On ancient erosion surfaces these are soils with water and root-impeading hardpans, and dark topsoil (Xerollic Durorthids, Durixerollic Camborthids, and Orthidic Durixerolls).

Soils on the flood-scoured, channeled scablands are similar to soils on the highly dissected lava benches in the western part of the Section. Shallow, stony soils (Lithic Camborthids, Haploxerolls, and Argixerolls) formed in loess. Cobbly and stony material from the basalt occur in a complex pattern with moderately deep soils (Xerollic Camborthids, Aridic Haploxerolls, and Argixerolls) formed in loess.

In the southern part, soils are moist except in summer months (xeric soil moisture regime). Soils commonly have dark, organic matter-rich topsoil; some are shallow to bedrock (Lithic Haploxerolls and Argixerolls); some have lime-enriched and clay-enriched subsoils (Typic or Calcic Argixerolls, and Calcic Haploxerolls); and some have thick dark topsoil (Pachic Haploxerolls and Argixerolls). An influence of volcanic ash is recognized in some soils (Vitrandic Argixerolls and Vitrandic Haploxerolls) in this part of the Section.

Potential Natural Vegetation. According to K  chler, the sagebrush-steppe is dominant, followed by fescue-wheatgrass and wheatgrass-bluegrass.

Fauna. Large herbivores are represented by a restricted distribution of mule deer and antelope. Coyote, black-tailed jackrabbit, cottontail rabbit, marmot, badger, and several ground squirrels compliment the small mammal component. Western rattlesnake, bullsnake, pond turtle, and several species of lizard are common. Marsh hawk, kestrel, red-tailed hawk and golden eagle are common avian components. Cold water streams and lakes are inhabited by rainbow trout, and introduced Centrarchids are common in reservoirs.

Climate. Precipitation averages 7 to 18 in (180 to 450 mm). August through November is dry. Humidity is low year round. Temperature averages 40 to 57   F (4 to 14   C) The growing season ranges from 100 to 200 days.

Surface Water Characteristics. A few rivers and streams are weakly to moderately incised. The Columbia River is the major surface water and includes several major reservoirs. Wetlands and marshes are extensive, but many have been drained for agriculture.

Disturbance Regimes. Wind is the principal disturbance feature. Composition and successional sequences of some communities have changed because of agricultural practices and the introduction of animal species into the valleys.

Land Use. Both dryland and irrigated agriculture dominate. Several specially designated areas are within the Section, including a military training site, two Native American reservations, a wildlife refuge, and Hanford nuclear reservation. A variety of communities are dispersed throughout and range from small rural developments to moderately large urban centers.

Cultural Ecology. Humans have occupied the Columbia Plateau and Okanogan Highlands Sections for at least 12,000 years. For the last 5,000 years, groups spent much of the year in river-oriented pithouse villages of 30 to 300 people. Hunting, salmon fishing, and root and berry collecting were the primary economic activities. They were also the backdrop for much of the social organization and spiritual beliefs. Hunting and fishing were important not only for the sustenance they provided, but for where, when, and how they were carried out. Burning (both intentional and otherwise) to improve plant growth for berry crops and big game forage was common; however, hunting pressure prior to nuro-American settlement may have contributed to the extinction of the Columbia Basin bison population (never a large population at any time in prehistory). Large pithouse villages with between 30 and 200 pit depressions have created small-scale localized ecological effects. Euro-American settlement and exploitation of the area began in the mid 1800's and intensified between 1875 and 1925. Historic activities include lumbering (especially in the Okanogan Highlands), railroad construction, dam building, grazing, wheat ranching, and irrigated farming. These activities have all created ecological effects on plant and animal species and other resources that far exceed most of those from prehistoric times.

Compiled by Pacific Northwest Region.

Province M341–Nevada-Utah Mountains Semi-Desert - Coniferous Forest - Alpine Meadow

Three Sections have been delineated in this Province: M341A–Central Great Basin Mountains; M341B–Tavaputs Plateau; and M341C–Utah High Plateaus and Mountains. These Sections are located in the west-central conterminous States, including parts of Nevada, Utah, and Colorado. The area of these Sections is about 43,600 mi² (112,900 km²).

Section M341A–Central Great Basin Mountains

Geomorphology. This area occurs within the Central Nevada Basin and Range physiographic province. The Central Great Basin Mountains section is located in central Nevada and a small area of western Utah. The dominant landforms are north-south trending mountains separated by broad, sediment-filled valleys, many of which have internal drainages. Mountains were formed by faulting and were subsequently modified by erosion. Large alluvial fans have developed at the mouths of most canyons. Some fans are coalescing, nearly burying the eroded mountains. Elevation ranges from 5,000 to 13,000 ft (1,500 to 4,000 m).

Lithology and Stratigraphy. Undifferentiated volcanic rocks from the Miocene and Oligocene epochs occur in this Section. Rhyolites and andesites also occur. Sedimentary rocks from the Miocene-Pliocene epoch, along with rocks from the Pennsylvanian period, are found, and limestone and dolomite from the Cambrian period occur. Intrusive igneous rocks form many of the mountain ranges. Playas are also evident in the internally drained valleys of this Section. Alluvial deposits occur in most of the valleys, and these include sand dunes.

Soil Taxa. Entisols and Aridisols occur in combination with mesic, frigid, and cryic soil temperature regimes, along with xeric and aridic soil moisture regimes. Large areas have saline-sodic affected soils.

Potential Natural Vegetation. Küchler vegetation types include Great Basin sagebrush and areas of saltbush-greasewood and juniper-pinyon woodlands. The Soil Conservation Service identifies the potential natural vegetation as saltbush-greasewood, big sagebrush, and pinyon-juniper woodland vegetation.

Fauna. During the Pliocene and the Pleistocene epochs, camels, horses, elephants, and bison were all abundant; early human inhabitants extirpated all but the bison. Bighorn sheep and pronghorn antelope were once common. Today bighorn sheep are being reintroduced to native ranges; pronghorn antelope are greatly reduced in range and number. Presently the

common ungulates are mule deer and introduced elk. Coyote and mountain lion are the typical large predators. Characteristic herpetofauna include western whiptail, rubber boa, common garter snake, leopard lizard, side-blotched lizard, and western toad. Fossil evidence indicates that historic bird populations are similar to what can be found presently, none of which are endemic. Sage grouse, sage thrasher, and sage sparrow are birds which characterize and are almost exclusively found in the sagebrush communities. Cassin's kingbird, gray flycatcher, scrub jay, pinyon jay, plain titmouse, bush-tit, blue-gray gnatcatcher, cedar waxwing, gray vireo, black-throated gray warbler, and Brewer's sparrow typify the pinyon-juniper woodlands.

Climate. Precipitation ranges from 5 to 25 in (125 to 625 mm) annually; the driest period is from midsummer to midautumn. Summers are dry and hot with low humidity. Winters are cold and dry. Temperature averages 38 to 50 °F (4 to 10 °C). The growing season ranges from 60 to 120 days.

Surface Water Characteristics. Water is scarce. Streams are small and intermittent. Reese River and Duck Creek are some of the major drainages in this Section. Small streams drain the mountain ranges and all areas have internal drainage. Ground water is also scarce.

Disturbance Regimes. Erosion by wind and water is occurring. Fires also occur.

Land Use. Livestock grazing is the primary use, with small areas used as hay fields and pasture land. Some mining has also occurred.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.

Section M341B–Tavaputs Plateau

Geomorphology. This area occurs within the Colorado Plateau physiographic province. The Tavaputs Plateau Section is located in eastern Utah and western Colorado. One of Utah's most rugged areas is between the relatively level interior of the Uinta Basin and the valleys cut in the Mancos Shale in Carbon, Emery, and Grand Counties. The structure is relatively simple. Strata of Cretaceous and Tertiary periods rise gradually southward and upward from the center of the Uinta Basin to reach elevations between 8,000 and 10,000 ft where they are abruptly cut off in great erosional cliffs that descend in giant steps to the valleys of the south; there elevations are between

4,000 and 5,500 ft. The great system of linear cliffs is evident. The lower one, most visible and best known, is the Book Cliffs. Above, and separated by a bench or valley as much as 10 mi wide, are the Roan Cliffs. For that part of the Uinta rim in Carbon County, there is a third, relatively short system, the Badland Cliffs. The cliffs are retreating from former positions far to the south. The tendency to retreat along a regular front has exercised a much greater influence than the Green River, which is confined to a relatively narrow gorge through the formations without interrupting the dominantly east-west sweep of the cliff system. Desolation Canyon traverses the Tertiary Section, and Gray Canyon cuts across the Cretaceous formations. In passing through these two canyons, the river drops about 600 ft (180 m). Elevation ranges from 7,300 to 10,000 ft (2,100 to 3,000 m). Local relief ranges from 5 percent on the broad plateau uplands, to steep vertical canyon sidewalls comprised predominantly of bedrock.

Lithology and Stratigraphy. Cretaceous period with Paleocene and Eocene period sedimentary rocks occur, which are mainly shales, sandstones, and siltstones. The Book Cliffs are carved mainly from marine Cretaceous sandstone, the Roan Cliffs were formed with Paleocene and Eocene epoch river and flood plain deposits, and the Badland Cliffs are from Eocene epoch lakebeds.

Soil Taxa. Entisols and Aridisols occur in combination with mesic and frigid soil temperature regimes, along with aridic soil moisture regimes at the lowest elevations. Between 8,000 and 10,000 ft (2,400 to 3,000 m) elevation, Mollisols dominate with frigid and cryic temperature regimes. Inceptisols are common with Douglas-fir. Most soils have concentrations of calcium.

Potential Natural Vegetation. Küchler vegetation types include juniper-pinyon and big sagebrush. The eastern part of this Section (Book Cliffs-Roan Plateau-East and West Tavaputs Plateau) as delineated by Stokes includes juniper-pinyon, black sagebrush, big sagebrush, mountain brush, Salina wildrye grasslands, ponderosa pine, aspen, Douglas-fir, and spruce-fir.

Fauna. Historically, desert bighorn sheep were found in the area, but were extirpated with the advent of settlers and widespread livestock grazing. Though moose probably are not indigenous, their range is now expanding into suitable habitat. Mountain bighorn sheep have been introduced in localized areas. Ring-necked pheasants, also introduced, are becoming more abundant. Fauna representative of desert shrub communities include rock wren, lark sparrow, sage sparrow, loggerhead shrike, horned lark, green-tailed towhee, Brewer's sparrow, red-tailed hawk, golden eagle, northern harrier, and kestrel. Pinyon-juniper and mountain brush communities support a variety of species, including mountain bluebird, blue-gray gnatcatcher, red breasted nuthatch, flycatcher, great horned owl and red-tailed hawk; obligate species include the pinyon jay and pinyon mouse. Fauna representative of high elevation sagebrush communities include sage grouse, mule deer, antelope, cougar, black bear, California

myotis, and faded pygmy rattlesnake. Species common to aspen and coniferous forest include brown creeper, western wood peewee, warbling vireo, MacGillivray's warbler, Townsend's solitaire, three-toed woodpecker, red-naped sapsucker, hairy and downy woodpeckers, red-tailed hawk, goshawk, Cooper's hawk, and sharp-shinned hawk; red squirrel, northern flying squirrel, deer, elk, cougar, bear, coyote, and hoary bat; and milk snakes. Species representative of riparian areas include yellow warbler, tree swallow, western kingbird, house wren, rufous-sided towhee, song sparrow, loggerhead shrike, hairy woodpecker, red-tailed hawk, and golden eagle; deer, elk, moose, cougar, bear, beaver and silver-haired bat; and Utah tiger salamander. Colorado River cutthroat trout are present as unique stream fauna. The Green River has been proposed as critical habitat for four endangered, endemic fishes. Colorado squawfish, razorback sucker, humpback chub, and bonytail chub. Two candidate species occur: flannelmouth sucker and roundtail chub.

Climate. Precipitation ranges from 8 to 35 in annually (200 to 890 mm). Much precipitation falls at higher elevations during winter months in the form of snow. Summers have afternoon thunderstorms that often result in debris flows from the side canyons. Lower elevations are somewhat dry and hot in summer and cold and moist in winter. Higher elevations are warm and wet during summer, and cold and wet during winter. Fall is generally dry and cool throughout the Section. Temperature averages 34 to 45 °F (1 to 7 °C). Mean January temperature at high elevation (e.g., Strawberry) is a maximum 28 °F and a minimum 4 °F. The mean for July is a maximum 80 °F and a minimum 45 °F. At lower elevations (e.g., Antelope), mean January temperature is a maximum 28 °F and a minimum 8 °F. The mean for July is a maximum 88 °F and minimum 58 °F. High elevation areas have approximately 40 frost free days, while lower elevations have about 120 frost free days.

Surface Water Characteristics. Water is scarce over most of the area and is generally confined to steep canyons such as the Green and White Rivers. Smaller drainages such as Timber, Sowards, and Indian Canyon deliver water to the Green after flowing into the Strawberry River in the Uinta Basin. Lakes and reservoirs are few, and many water developments have been put on public lands to distribute to livestock and to provide water for wildlife.

Disturbance Regimes. Occurrence of fire is common, with large grass and shrub areas burning rapidly. At higher elevations, small fires are common, generally caused by lightning. They are usually confined to aspect and vegetation type. These fires are generally not extensive.

Land Use. Grazing, mining, recreation, and wildlife habitat are the major land uses. Hay and pasture land also occur to a very limited extent along drainage ways.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.

Section M341C—Utah High Plateaus and Mountains

Geomorphology. This area occurs within the Colorado Plateau physiographic province. It includes portions of south-central Utah. This Section is located in the northwest corner of the Colorado Plateau physiographic province. These plateaus are primarily fault-controlled, have relatively high elevations, are aligned in a north-south direction, and are underlain with rocks of Mesozoic and Cenozoic eras. The east flank of the high plateaus is bordered by the Canyonlands. The western boundary is faulted, separating it from the Basin and Range physiographic province. They are a series of high plateaus that are gently rolling on top, but rise steeply from the valley bottoms. They are separated by north-south trending valleys. Landslides have influenced many areas in this Section, and several plateaus were sites of local icecaps during at least the Wisconsin age. The tops of the plateaus have been capped with volcanic flows and glacial deposits. Colorful badland topography exists near Bryce Canyon and Cedar Breaks. This Section can be divided into three north-south groups that are separated from each other by two major structural trenches. The main plateaus of the western strip, from south to north, are the Markagunt, Tushar, Pavant, and Gunnison; the plateaus of the middle strip are the Paunsaugunt and Sevier; those

of the eastern strip are the Aquarius, Awapa, Fish Lake, and Wasatch. The depression which divides the western and middle plateau groups is the Sevier-Sanpete Valley. This depression is largely controlled by the Sevier Fault at its east side. The middle and eastern plateau strips are separated by Grass Valley, another fault-controlled depression, and by the Paunsaugunt Fault. The western boundary of the Utah High Plateaus and Mountains Section also follows the northern part of Hurricane Fault.

The general outline of this Section is determined by a series of northeast-southwest trending faults. The boundary rises from the levels of the plateaus immediately north of the Grand Canyon to the highest of the High Plateaus and includes a series of cliffs and associated rock terraces which have been named according to the predominant colors of the geological formations responsible for them. This ascent takes place over a distance of 40 to 50 miles. The cliffs have a general east-west trend, in contrast to the faults of the area. Five cliffs have regional extent; they are, in order from south to north the Chocolate, Vermillion, White, Gray, and Pink Cliffs. Each cliff is developed on a resistant geological formation ranging in age from the Triassic period to Eocene epoch. The cliffs are cuesta scarps developed on northward-dipping resistant formations. Elevation ranges from 5,000 to 13,000 ft (1,500 to 4,100 m).



Eroded mountains and canyons in the southern portion of this Section form the area designated as the Zion National Park.



The northern part of the Utah High Plateaus and Mountains Section on the Manti-La Sal National Forest.

Lithology and Stratigraphy. The northern portion is Miocene, Oligocene, and other undivided Tertiary volcanic rocks. The southern portion of the Section is Jurassic, Cretaceous, and Paleocene-Eocene aged sedimentary rocks, mostly sandstones and shales.

Soil Taxa. Mollisols, Entisols, Inceptisols, and Alfisols are in combination with mesic, frigid, and cryic soil temperature regimes, along with ustic, xeric, and udic soil moisture regimes.

Potential Natural Vegetation. Küchler vegetation types include western spruce-fir forest, Arizona pine forest, and spruce-fir-Douglas-fir forest. The Soil Conservation Service identifies potential natural vegetation as conifer, aspen, grasses, mountain shrub, and sagebrush-grass. Areas of big sagebrush also occur.

Fauna: This Section was once dominated by Rocky Mountain bighorn sheep, and large numbers of antelope and Utah prairie dogs; there were fewer bison, elk, mule deer, wild turkeys, and desert bighorns. Rocky Mountain sheep and bison have been extirpated. Elk and wild turkey were extirpated historically, but both have been re-introduced; currently, elk are found throughout their historic range. Large predators included timber wolves, grizzly bears, black bears, cougars, bobcats, gray foxes, and coyotes. Timber wolves and grizzly bears have been extirpated. Northern goshawks, flammulated owls, wolverines, flying squirrels, red squirrels, snowshoe hares, blue grouse, Steller's jays, and three-toed woodpeckers were found throughout spruce-fir and mixed conifer forests. Wolverines, never plentiful, are no longer found in this area, and three-toed woodpecker populations are reduced in range and number. Boreal toads, Utah tiger salamanders, and Utah mountain kingsnakes typify herpetofauna in and around high elevation ponds, lakes, wetlands, and riparian areas, although boreal toads are greatly reduced in number and range. Golden eagles, mountain bluebirds, loggerhead shrikes, Brewer's sparrows,

and burrowing owls typify bird species found in plateau and valley grasslands. Ring-tailed cats and peregrine falcons were found in canyon areas; presently, peregrines are sparsely distributed throughout the Section. Riparian corridors are used by many neotropical bird species such as western wood peewee, lazuli bunting, and warbling vireo. Leatherside chub, Utah chub, and native Bonneville and Colorado cutthroat trout are unique stream fauna.

Climate. Precipitation ranges from 14 to 35 in (375 to 900 mm) annually, with precipitation being distributed throughout the year. Much of the precipitation falls as snow. Summer precipitation patterns provide limited moisture during the growing season. Temperature averages 32 to 47 °F (0 to 8 °C). The growing season ranges from 20 to 120 days.

Surface Water Characteristics. Streams, lakes, and ground water supply adequate water for grazing and forest growth. Perennial streams are frequent and drain into the Sevier, Virgin, or Colorado River. Some major lakes are Piute Reservoir, Panguitch Lake, Scofield Reservoir, Joes Valley Reservoir, Fish Lake, and Otter Creek Reservoir.

Disturbance Regimes. The primary disturbance forces are infrequent mass movements and erosion from water. Historically, fire was a major disturbance that modified the vegetation. Fire suppression practices during the past century has altered this process.

Land Use. Grazing for sheep and cattle is the major land use. Timber production also occurs on the high plateaus. National parks and monuments bring abundant recreational use into the area. Coal mining is an important use on the Wasatch Plateau.

Cultural Ecology. Reserved.

Compiled by Intermountain Region.

Chapter 50

Province 411—Everglades Province

One Section has been delineated in this Province: 411A—Everglades. This Section is located in southern Florida and has an area of about 7,800 mi² (20,200 km²).

Section 411A—Everglades

Geomorphology. This Section is in the Coastal Plains geomorphic province. The predominant landform is a flat, weakly dissected alluvial plain formed by deposition of marine sediments onto a submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore-zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation ranges from sea level to 80 ft (25 m). Local relief ranges from 0 to 10 ft (3 m).

Lithology and Stratigraphy. Rocks were formed during the Cenozoic era. Oölitic limestone, which underlies much of south Florida, formed during the Tertiary period and consists of marine deposits that are calcareous and highly fossiliferous. Quaternary period strata consist of poorly consolidated sands and gravels.

Soil Taxa. Soils are mostly Saprists and Fibrists. Medisaprists occur over shallow limestone bedrock. Medifibrists and Medisaprists formed over mineral parent materials. Psammaquents and Ochraqualfs have developed where limestone rocks are at greater depths. Along the coasts are Sulfihemists and Sulfaquents. Soils in this Section have a hyperthermic temperature regime and are mostly aquic in moisture regime. Most soils inland from the coasts are poorly drained, shallow, and moderately textured. Some coastal soils are deep sands that are well drained or excessively drained.

Potential Natural Vegetation. Küchler classified five potential communities: Everglades (*Mariscus*, *Magnolia-Persea*); mangrove, cypress savanna, and subtropical pine forest. This Section is dominated by two principal potential natural communities adapted to hydric conditions: an extensive treeless savanna (the Everglades) on the eastern side of the Section, and forested woodlands (the Big Cypress Swamp) on the western side. The Everglades is a shallow, broad (60 mi, 95 km) river with freshwater flowing southward from Lake Okeechobee to the Gulf of Mexico. Physiognomy of vegetation varies by duration of inundation and amount of salt content. Vegetation includes: grasses in permanently submerged freshwater habitats; trees in dry to intermittently flooded fresh water habitats; and shrubs to small trees in saltwater estuary habitats. Predominant vegetation of flooded freshwater habitats includes sawgrass (actually a sedge), swamp lily, and spatterdock; on islands of slightly higher elevation (hammocks), trees include slash pine,

royal palm, gumbo limbo, and strangler fig. Epiphytes are common. Big Cypress Swamp, and other adjacent areas to the north, are characterized by intermittently flooded freshwater habitats with very poor drainage that are dominated by cypress; oaks and magnolias occupy better drained areas. Poorly drained soils along the east coast, and farther inland along the west coast, are dominated by south Florida slash pine. Sand pine, with scrub oak and saw palmetto understory, occupies excessively drained, deep sands. Both south Florida slash and sand pine are well adapted to an environment of frequent fire. Coastal areas influenced by saltwater tidal zones are occupied by successive zones of vegetation, from freshwater to saltwater environments, of button mangrove, black mangrove, and red mangrove, respectively. Other species common to this tropical environment include Florida fishpoison-tree, Bahama lysiloma, Royal poinciana, tamarind, shortleaf fig, Florida royalpalm, Jamaica thatchpalm, and oxhorn bucidia. Key West Cephalocereus, a tree-sized member of the cactus family, grows in thin, rocky soils of the Florida Keys. Exotic species are creating a threat to native species. For example, the cajuput, or bottle-brush tree, a native of Australia has been planted widely as an ornamental and is now invading the Everglades National Park. Also, the water hyacinth, a free-floating Brazilian herb, clogs waterways.

Fauna. Freshwater habitats are occupied by woodstork, bluegill, crayfish, Florida gar, largemouth bass, purple gallinule, alligator, ibis, zebra butterfly, Everglades kite, and apple snail. Characteristic fauna of hammocks are tree snails, barred owl, white-tailed deer, and Florida panther. In saltwater habitats, typical fauna include great white heron, American crocodile, loggerhead turtle, manatee, pink shrimp, mangrove snapper turtle, blue crab, coon oyster, brown pelican, osprey, roseate spoonbill, and southern bald eagle. Key deer are restricted to several small islands on the southern coast. Many birds of this Section occur over broader areas of Florida or south into islands of the Caribbean Sea. These include gray kingbird, blue-gray tanager, swallow-tailed kite, Caspian tern, stilt sandpiper, magnificent frigatebird, brown noddly, smooth-billed ani, white-crowned pigeon, and short-tailed hawk. Geckos include yellow-headed, indigo-Pacific, and reef. Crested, bark, and brown anoles are common. There are many introduced species of fauna. At least six species of the Everglades environment are threatened or endangered.

Climate. Annual precipitation ranges from 50 to 64 in (1,270 to 1,620 mm). About one-third of this total occurs during the fall and winter dry season. Mean annual temperature is from 72 to 77 °F (22 to 25 °C). The frost-free growing season lasts for 330 to 365 days. Key West, an island about 100 miles south of the mainland, has no record of freezing temperature.

Surface Water Characteristics. Other than precipitation, the source of most surface water in the Everglades is Lake Okeechobee, about 750 mi² (1,940 km²) in area, immediately north of this Section. Most waterways are canals that were built to carry a moderate to high volume of water at very low velocity. The water table is high in many areas, resulting in poor natural drainage and abundance of wetlands. A poorly defined drainage pattern has developed on this landscape, which is relatively young and weakly dissected. Palustrine systems having seasonally high water levels are abundant. This Section adjoins the West Indian Marine and Estuarine provinces.

Disturbance Regimes. Hurricanes are probably the most widespread form of natural disturbance, followed by infrequent fires during the winter dry season. Fire consumes irregular areas of organic soils, which fill with water during the wet season to make shallow lakes.

Land Use. Much of the land along the east and west coasts has been cleared of natural vegetation, originally for agriculture, but more recently for urban development. This Section contains the Everglades National Park, the Seminole and Miccosukee Native American reservations, and several national wildlife refuges.

Cultural Ecology. The mild, almost tropical-like climate has been a major factor in the rapid development of south Florida, a Section of relatively few natural resources. Following initial settlement by Archaic peoples, the Seminoles became the first modern inhabitants of the

Everglades as they retreated from settlers and soldiers in more northern areas. A project to drain the Everglades was initiated in the early 1900's to allow cultivation of vast areas of fertile, organic soils for winter vegetables. During this time, extension of a railroad into south Florida along the east coast contributed to several cycles of land speculation followed by depression. During the mid century, populations increased due to agricultural crops and a service-based economy related to expanded tourism. A narrow band of better drained soils along the east and west coasts developed rapidly into almost continuous metropolitan areas. During the late 1900's, populations again surged as a result of retirement relocations from northern states. Increased populations place heavy demands on freshwater resources, especially during drought years, at the expense of maintaining water flows from Lake Okeechobee southward into the Everglades. Development of large sugar cane fields south of Lake Okeechobee also increased nutrient levels of water runoff and caused additional stress on natural aquatic environments. Introduction of exotic plant and animal species has stressed native populations of some species. Relatively few of the current human population is native to the Section, and previous attitudes have been more sympathetic toward development than conservation. However, increased attention is now being given to restoring historic patterns of water levels and movement in the Everglades, especially since the Everglades National Park was established in 1947.

Compiled by Southeastern Forest Experiment Station.



Sedges and grasses dominate much of the shallowly inundated Everglades; shrubs grow on islands. White-tailed deer are common.

Chapter 51

Province M411–Puerto Rico

One Section has been delineated in this Province:
M411A–Dry-Humid Mountains. For the present time, this Section includes only the main island of Puerto Rico, which has an area of about 3,700 mi² (9,600 km²).

Section M411A–Dry-Humid Mountains

Geomorphology. This Section is an island of volcanic and tectonic origin situated in the Caribbean Sea at approximately 18° N and 66° W. Landforms consist of an east-to-west oriented band of mountains in the south-central part of the island, foothills along both sides of the mountains, and coastal lowlands. Small areas of coastal valleys are on the eastern and western coasts. Elevation averages less than 500 ft (150 m) in the coastal lowlands, 1,000 ft (300 m) in the foothills, and 3,000 ft (900 m) in the mountains. The highest mountain summit on the island, Cerro de Punta, is 4,389 ft (1,338 m) in elevation.

Lithology and Stratigraphy. Reserved.

Soil Taxa. Predominant soils are Tropepts, Humults, and Paleudults. Eutropepts and Tropohumults are on steep side slopes in east-central and west-central areas. Tropaquepts, Fluvaquents, and Hapludolls are on flood plains and poorly drained areas. Troposaprists and Fluvaquents are in swamps and marshes. Rendolls and Tropudalfs are major soils in the limestone karst area. These soils have an isohyperthermic or isothermic temperature regime and kaolinitic or mixed mineralogy.

Potential Natural Vegetation. The general vegetation type is tropical (or subtropical, depending on definition) in temperature regime and dry to hydric in moisture regime. The potential vegetation of Puerto Rico, nearby islands, and the U.S. Virgin Islands has been described according to life zones of the Holdridge system of environmental classification. Six life zones have been recognized that are highly correlated with seasonal moisture regimes.

A small area (less than 0.1 percent) of tropical lower montane rain forest is present above the tropical rain forest. Annual precipitation may average 175 in (4,500 mm) and relative humidity averages above 98 percent.

The tropical rain forest (0.1 percent) occurs near the eastern coast, only on the windward side of the Luquillo Mountains, where precipitation exceeds 150 in (3,800 mm) annually. Species are similar to the tropical wet forest, but palms and epiphytes (“air plants”) dominate.

The tropical lower montane wet forest occurs on only about 1 percent of Puerto Rico, beginning at an elevation of about 3,300 ft (1,000 m) and extending to the summits



Epiphytes and palms are prevalent in the tropical rain forest.

of most mountain peaks. Common vegetation consists of palo colorado (swamp cyrilla), nemoca, caimitillo, and caimitillo verde. This zone contains the main nesting sites of the nearly extinct Puerto Rican parrot, which nests in hollow trunks of cyrilla trees.

The tropical wet forest occupies 22 percent of the island and occurs in areas of annual precipitation ranging from 80 to 160 in (2,000 to 4,000 mm). It occupies most of the mountains of high altitude, above 2,000 ft (600 m). Most trees are evergreen and over 150 species occur. Vegetation common to this zone includes helecho gigante (common tree-fern), tabonuco, motillo, and ausubo (bulletwood). Other main species include palma de sierra (sierra palm) and spiny tree-fern. Many epiphytic ferns, bromeliads, and orchids are common.

The tropical moist forest covers over half of the island (58 percent), except for the southern coast and high interior mountains, and is delineated by a zone of annual

precipitation ranging from 40 to 80 in (1,000 to 2,000 mm). Many trees in this zone are drought deciduous, as a result of periods of low rainfall in January through April. Characteristic species include mangle (black, red, and white mangroves), palma real (Puerto Rico royalpalm), roble blanco (white cedar), tulipan africano (African tulip tree), bucayo gigante (mountain immortelle), guama (sweetpea), cedro hembra (Spanish-cedar), algarrobo (West Indian locust), flamboyán (flamboyant-tree), and jagüey blanco (shortleaf fig).

The tropical dry forest occupies 18 percent of Puerto Rico and occurs where rainfall ranges from 24 to 40 in (600 to 1,000 mm) annually. This forest is prevalent along the southwest coast and on most neighboring islands, including the Virgin Islands. Vegetation is mostly drought deciduous. Palms are absent, but cacti, thorny legumes, grasses, and short trees with flattened crowns are common. Indicator species include almácigo (turpentine tree), bayahonda (mesquite), sebucán (dildo), tachuelo

(fustic), ucar (oxhorn bucidá), guayacán (lignumvitae), guayacán blanco (hollywood lignumvitae), zarcilla (tatan), tamarindo (tamarind), tamarindo silvestre (steel acacia), aroma (sweet acacia), and quenepa (Spanish lime).

Fauna. Reserved.

Climate. Mean annual precipitation ranges from about 25 to 150 in (600 to 3,800 mm). Annual temperature is about 75 to 77 °F (24 to 25 °C) and ranges from about 73 °F (23 °C) in January to 80 °F (27 °C) in July. The growing season lasts for 365 days.

Surface Water Characteristics. Reserved.

Disturbance Regimes. Reserved.

Land Use. Reserved.

Cultural Ecology. Reserved.

Compiled by Southern Region.



Cacti and thorny legumes are characteristic vegetation of the tropical dry forest along the southwestern coast and on some islands.

Province M423–Hawaiian Islands

One Section has been delineated in this Province: M423A–Hawaiian Islands. This Section includes all islands of the State of Hawaii. The area of this Section is about 6,500 mi² (16,800 km²).

Section M423A–Hawaiian Islands

Geomorphology. Most land areas of this Section were formed from shield volcanoes. Predominant landforms range from currently forming to deeply incised canyons; alluvial fans, coastal plains, and coral atolls. Elevation ranges from sea level to 13,796 ft (0 to 4,194 m).

Lithology and Stratigraphy. Volcanic flows of various ages are evident. The northwest islands and some coastal areas based on coralline limestone and sands.

Soil Taxa. Inceptisols, Histosols, Oxisols, Mollisols, and Ultisols occur in combination with isohyperthermic, isothermic, or isomesic soil temperature regimes and ustic, udic, or aridic soil moisture regimes.

Potential Natural Vegetation. Küchler classified potential vegetation as sclerophyllous forest, shrubland

and grassland; guava mixed forest; ohia lehua forest; lamma-manale forest; koa forest; koa-mamani parkland; grassland; microphyllous shrubland; and barren.

Over 100 distinct natural communities occur, including tropical coastal vegetation, lowland wet forests, montane wet forests and bogs, montane moist forests and parkland, subalpine vegetation, alpine vegetation, lowland grasslands and shrublands, lowland dry and mesic forests, montane grasslands and shrublands, and montane dry forests. About 90 percent of native plant taxa are endemic. O'hia lehua and koa are the two most common large trees and are found in a variety of ecosystems. Naturalized vegetation and fire dynamics have resulted in conversions to mixed exotic forests, shrublands, and grasslands.

Fauna. There are native sea birds, waterfowl, water birds, forest birds, raptors, honeycreepers, and numerous exotic birds. Over half of all native birds are endemic. One native terrestrial mammal (bat) is present; introduced species include mongoose, pig, deer, rat, mouse, sheep, and goat. No native terrestrial amphibians or reptiles occur. There are several hundred species of endemic tree snails. Cave and anchialine pool fauna are present.



This steep, highly dissected landscape of the Hawaiian Islands is volcanic in origin and is dominated by tropical vegetation.

Climate. Precipitation ranges from 5 to 460 in (130 to 11,680 mm). Rainfall is highly seasonal in dry areas, and is less seasonal in wet areas. Relative humidity ranges from 50 percent (average daily minimum, dry coastal area) to 90 percent and above (average daily maximum, wetter areas). Some snow occurs on highest peaks. Temperature ranges from 48 to 77 °F (9 to 25 °C). The growing season is mostly 365 days, decreasing to about 300 days at highest elevations.

Surface Water Characteristics. Fast moving perennial streams are common in wetter parts of mountain areas. Few to no perennial streams occur elsewhere because of seasonal rainfall and a permeable substrate.

Disturbance Regimes. Lava flows and ash and cinder falls periodically occur on the Island of Hawaii. Fire rarely occurred before human settlement; now it is frequent in dry areas and significant in wet areas. Hurricanes were infrequent and mild before 1950, but three severe hurricanes have damaged Kauai since then. Drought tends to be localized. Nearly all streams on wetter slopes of Maui, Big Island, and Oahu are diverted by ditch and tunnel systems or urban channelization. Exotic animals have caused severe grazing and dispersal of

exotic plants. Exotic plants suffer from severe competition and transformation of soil, water, and fire regimes.

Land Use. Settlement, agriculture, grazing, urbanization, and re-forestation have transformed most coastal and lowland areas and many upland areas. Conversion of upland and forest areas continues. Coastal and agricultural lands are being further urbanized. Land use changes plus impacts of exotic species are contributing to continuing extinctions. About half of all native bird species estimated to have existed in Hawaii are extinct; over a third of those remaining are listed as threatened or endangered. Nearly a quarter of native plants are proposed or listed as threatened or endangered.

Cultural Ecology. Substantial human influence began about the early fourth century with the introduction of animal and plant species by the settlers who were the ancestors of today's native Hawaiians. European contact, beginning in 1778 A.D., brought more major changes, continuing through present time. Contemporary attitudes and beliefs are varied, and cultural diversity is very high.

Compiled by Pacific Southwest Region.

Appendix A

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- Stout, N.J. 1958. Atlas of forestry in New York. Bulletin 41. Syracuse, NY: State University, College of Forestry, 95 p.
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Severinghaus, C.W.; Brown, C.P. 1956. History of white-tailed deer in New York. New York Fish and Game Journal. 3(2): 129-167.

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Goldwithe, J.W. 1951. The geology of New Hampshire: Part I - surficial geology. [Place of publication unknown]: New Hampshire State Planning and Development Commission. 84 p.

Sperduto, D.D. 1993. Forest communities of New Hampshire. Concord, NH: New Hampshire Natural Heritage Inventory, Department of Resources and Economic Development. 21 p.

Van Diver, B.B. 1987. Roadside geology of Vermont and New Hampshire. Missoula, MT: Mountain Press Publishing Co. 230 p.

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- Trautman, M.B. 1981. The fishes of Ohio. Columbus, OH: Ohio State University Press. 782 p.

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Geologic map of Kentucky [Geologic]. M.C. Noger, comp. 1988. Reston, VA: U.S. Department of Interior, Geological Survey. 1: 500,000.

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- Smalley, Glendon W. 1982. Classification and evaluation of forest sites on the Mid-Cumberland Plateau. Gen. Tech. Rep. SO-38. New Orleans, LA: U.S. Department of Agriculture. Forest Service. Southern Forest Experiment Station. 58 p.
- Smalley, Glendon W. 1986. Classification and evaluation of forest sites on the Northern Cumberland Plateau. Gen. Tech. Rep. SO-60. New Orleans, LA: U.S. Department of Agriculture. Forest Service. Southern Forest Experiment Station. 74 p.

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Smalley, Glendon W. 1984. Classification and evaluation of forest sites in the Cumberland Mountains.

Gen. Tech. Rep. SO-50. New Orleans, LA: U.S. Department of Agriculture. Forest Service. Southern Forest Experiment Station. 84 p.

The following references apply to Sections 222A:

- Missouri, Rolla [quadrangle]-geologic map [Geology]. W.P. Pratt; M.A. Middendorf; I.R. Satterfield; P.E. Gerdemann, comps. cartogs. 1992. Miscellaneous Investigations Map I-1998. Washington, DC: U.S. Department of Interior, Geologic Survey. 1: 250,000.

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The following references apply to Sections 222A, 222D, 222G, 222H, 222I, 222J, 222K, 222L, 222M, 222N, 251A, 251B, 251C, 251D, and 251E:

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**The following references apply to Sections 222D,
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The following references apply to Sections 222E:

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26241.
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M221B, M221C, and M221D:**

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The following references apply to the Virginia portion of M221A, M221D, 231A, and 232A:

Frye, Keith. 1986. Roadside geology of Virginia. Missoula, MT: Mountain Press Publishing Company. 278 p.
Martof, Bernard S.; Palmer, William M.; Bailey, Joseph R.; Harrison, Julian R., III. 1980. Amphibians and reptiles of the Carolinas and Virginia. Chapel Hill, NC: University of North Carolina Press. 264 p.

The following reference applies to Section M221D:

Moore, Harry L. 1988. A roadside guide to the geology of the Great Smoky Mountains National Park. Knoxville, TN: University of Tennessee Press. 178 p.

The following references apply to Sections: M221D, and the NC portions of 231A, 232B, and 232C:

Menhinick, Edward F. 1991. The freshwater fishes of North Carolina. Raleigh, NC: North Carolina Wildlife Resources Commission. 227 p.
Schafale, Michael P.; Weakley, Alan S. 1990. Classification of the natural communities of North Carolina—Third approximation. Raleigh, NC: North Carolina Department of Environment, Health, and Natural Resources; Division of Parks and Recreation; North Carolina Natural Heritage Program. 325 p.

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Spearing, Darwin. 1992. Roadside geology of Texas. Missoula, MT: Mountain Press Publishing Company. 418 p.

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Balster, C.A.; Parsons, R.B. 1968. Geomorphology and soils, Willamette Valley, Oregon. Report 265. [Publication location unknown]: [University unknown], Oregon Agricultural Experiment Station. 31 p.
Brockway, D.G. 1983. Plant association and management guide for the Pacific silver fir zone, Gifford Pinchot National Forest. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. R6-Ecol-130a-1983. 122 p.
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- Hopkins, W.E. 1979. Plant associations of the Fremont National Forest. Report R6-Ecol-79-004. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 106 p.
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- Larson, D.M. 1976. Soil resource inventory, Deschutes National Forest. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 381 p.
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- Orr, E.L.; Orr, N.W.; Baldwin, E.M. 1992. Geology of Oregon, 4th ed. [Location of publication unknown]: Kendall/Hunt Publishing. 223 p.
- Patching, W.R. 1987. Soil survey of Lane County Area, Oregon. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service. 369 p.
- Pringle, R.F. 1986. Soil survey of Grays Harbor County Area, Pacific County, and Wahkiakum County, Washington. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service. 256 p.
- Halluin, L.J. 1987. Soil survey of Clallam County, Washington. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service. 213 p.
- Radtke, S.; Edwards, R.V. 1976. Soil resource inventory, Umpqua National Forest. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 216 p.
- Rother, E.W. 1977. Soil resource inventory, Okanogan National Forest. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 194 p.
- Rowes, S. 1978. Soil resource inventory, Mt. Hood National Forest. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 312 p.
- Snyder, R.V.; Wade, J.M. 1972. Soil resource inventory, Snoqualmie National Forest-Westside. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 228 p.
- Snyder, R.V.; Wade, J.M. 1970. Mt. Baker National Forest soil resource inventory. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 267 p.
- Snyder, R.V.; Meyer, L.C. 1971. Gifford Pinchot National Forest soil resource inventory. Washington, DC: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 131 p.
- Snyder, R.V.; Bush, G.S., Jr.; Wade, J.M. 1969. Soil resource management survey report, Olympic National Forest. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 158 p.
- Soil resource inventory, Siuslaw National Forest [Soils]. G.J. Badura, H.A. Legard, R.C. Meyer, cartogs, 1974. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 1: 63,360; [Projection unknown].
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- Volland, L.A. 1985. Plant associations of the central Oregon pumice zone. Report R6-Ecol-104-1985. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 138 p.
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Eastyerbrook, D.J.; Rahm, D.A. 1970. Landforms of Washington, the geologic environment. [Location of publisher unknown]: Western Washington State College. 156 p.

The following references apply to Sections 242A, M242A, M242B, M242C, M332G, M333A, 342H, and 342I:

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J.M. Omernik, A.L. Gallant, cartog, 1986. Corvallis, OR: U.S. Environmental Protection Agency. 1: 2,500,000; [Projection unknown].

Franklin, J.F.; Dryness, C.T. 1973. Natural vegetation of Oregon and Washington. Gen. Tech. Rep. PNW-8. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 417 p.

Omernik, J.M.; Gallant, A.L. 1986. Ecoregions of the Pacific Northwest. EPA/600/3-86/033. Corvallis, OR: U.S. Environmental Protection Agency. 39 p.

STATSGO, Oregon and Washington [Soils]. 1993. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service. 1: 250,000; [Projection unknown].

The following references apply to Sections 251B, and 251C:

Prior, J.C. 1991. Landforms of Iowa. [Place of publication unknown]: University of Iowa Press. 153 p.

The following references apply to Sections 251D:

Bleuer, N.K.; Shaver, R.H. 1987. The Lover's Leap section and related observations of multiple and cross-cutting glacial drifts in the Great Bend area, Indiana, In: Biggs, D.L., ed. North central section of the Geological Society of America. Centennial Field Guide. Volume 3: 343-348.

The following references apply to Sections 251E, 251F, 255A, 311A, and 331B:

Duck, L.A.; Fletcher, J.B. 1945. A survey of the game and furbearing animals of Oklahoma. Department of Wildlife Restoration and Furbearing Animal Research, [Location of publication unknown]: Oklahoma Game and Fish Commission. Chapter II.

The following references apply to Sections 251F, 251G, 331A, 331C, 331D, 331E, 331F, 331G, 331H, 331I, 332C, 332D, 332E, M331A, M331B, M331G, M331H, M331I, M332A, M332B, M332C, M332D,

M332E, M333B, M333C, M333D, M334A, 342A, 342F, and 342G:

Fenneman, N.M. 1931. Physiography of the western United States. New York: McGraw-Hill Book Company. 534 p.

The following references apply to Sections 251F, 251G, 331C, 331H, 331I, 332C, 332D, 332E, M331G, M331H, M331I, M334A, 342F, and 342G:

Armstrong, David. 1972. Distribution of mammals in Colorado. [No other information known].

Barter, George; Stone, Michael. 1980. Amphibians and reptiles of Wyoming. [No other information known].

Cassidy, James, ed. 1990. Book of North American Birds. [No other information known].

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Stebbins, Robert C. 1966. A field guide to western reptiles and amphibians. [No other information known].

The following references apply to Provinces 261, 262, 263, M261, and M262, and Sections 322A, 322C, and 341D:

Geomorphic provinces and major faults [Physiography]. 1986. Note 36. [Place of publication unknown]:

California Department of Mines and Geology. 1: 3,500,000; [Projection unknown].

Geologic map of California [Geology]. 1966. [Place of publication unknown]: California Department of Mines and Geology; U.S. Department of Interior, Geological Survey. 1: 2,500,000; colored.

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Küchler, cartog. 1977. [Place of publication unknown]: University of Kansas, Department of Geography. 1: 1,000,000, colored.

Sawyer, J.O. 1993. California native plant society plant community inventory, Series descriptions of California vegetation. [Other information unknown]. Unpublished draft on file: U.S. Department of Agriculture, Forest Service, Pacific southwest Region.

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The following references apply to Sections 313A, 313B, 313C, 313D, 313E, 315A, M313A, M313B, 321A, 322B, 331J, and M331F:

Carlton, O. [and others]. 1979. Terrestrial ecosystems of the Southwest. Albuquerque, NM: U.S. Department of Agriculture, Forest Service, Southwestern Region. [Pages unknown].

Carlton, O. [and others]. 1991. General Ecosystem Survey. Albuquerque, NM: U.S. Department of Agriculture, Forest Service, Southwestern Region. 311 p.

Hendricks, D.H. 1985. Arizona Soils. [Place of publication unknown]: University of Arizona, Department of Soil and Water Science. 244 p.

Staff, University of New Mexico. 1986. New Mexico in Maps. 2d ed. [Place of publication unknown]: University of New Mexico. 408 p.

U.S. Department of Agriculture, Forest Service, Southwestern Region. 1986. Terrestrial Ecosystem Survey Handbook. Albuquerque, NM: U.S. Department of Agriculture, Forest Service, Southwestern Region. [Pages unknown].

The following references apply to Sections 331A, 331D, 331E, 331F, 331G, M331A, M331B, M332A, M332B, M332C, M332D, M332E, M333A, M333B, M333C, and M333D:

Burleigh, T. 1972. Birds of Idaho. Caldwell, ID: Caxton Printers, Ltd. 467 p.

Stephens, D.A.; Sturts, S.H. 1991. Idaho bird distribution. Special Publication 11. Pocatello, ID: Idaho Museum of Natural History. 76 p.

The following references apply to Sections 331A, 331D, 331E, 331F, 331G, M331A, M331B, M332A, M332B, M332C, M332D, M332E, M333B, M333C, and M333D:

Montagne, Clifford; [and others whose names are unknown]. 1982. Soils of Montana. Bulletin 744. Bozeman, MT: Montana State University, Montana Agriculture Experiment Station. 95 p.

The following references apply to Sections 331A, 331D, 331E, 331F, 331G, 332A, and 332B:

Stewart, R.E. 1975. Breeding birds of North Dakota. Fargo, ND: Tri-College Center for Environmental Studies. 295 p.

U.S. Department of Interior, Fish and Wildlife Service, Salyer National Wildlife Refuge. 1989. Checklist of birds of the Souris Loop National Wildlife Refuges. Upham, ND: U.S. Department of Interior, Fish and Wildlife Service, Salyer National Wildlife Refuge. [Pages unknown].

U.S. Department of Interior, National Park Service, Theodore Roosevelt National Park. 1991. Theodore Roosevelt National Park fauna database. Medora, ND: U.S. Department of Interior, National Park Service, Theodore Roosevelt National Park. [Pages unknown].

The following references apply to Sections 331A, 331D, 331E, 331F, 331G, M331A, M331B, M332A, M332B, M332C, M332D, M332E, M333A, M333B, M333C, M333D, and 342A:

Johnsgard, P.A. 1992. Birds of the Rocky Mountains. Lincoln, NE: University of Nebraska Press. 504 p.

Reel, [Initials unknown]; [and others whose names are unknown]. 1989. Caring for our natural community, Region 1 - threatened, endangered and sensitive species program. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region. 309 p.

The following references apply to Sections 331A, 331D, 331E, 331F, 331G, M331A, M331B, M332A, M332B, M332C, M332D, M332E, M333B, M333C, M333D, and 342A:

Arno, Stephen F. 1979. Forest regions of Montana. Res. Pap. INT-218. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 39 p.

Bergeron, D.; Jones, C.; Genter, D.L.; Sullivan, D. 1992. P.D. Skaar's Montana bird distribution. 4th ed. Special Publication 2. Helena, OR: Montana Natural Heritage Program. 116 p.

McEneaney, T. 1993. Birder's guide to Montana. Helena, MT: Falcon Press. 316 p.

The following references apply to Sections 331A, 331D, 331E, 331F, 331G, M332A, M332B, M332C, M332D, M332E, M333A, M333B, M333C, and M333D:

Sturts, S.H. 1993. Birds and birding routes of the Idaho Panhandle. [Location of publication unknown]: [Publisher unknown]. Cooperative publication of Idaho Department of Fish and Game, Idaho Panhandle National Forests, US Bureau of Land Management, Spokane Audubon Society. 63 p.

The following reference applies to Sections 331A and 342I:

Daubenmire, R. 1970. Steppe vegetation of Washington. Technical Bulletin 62. Pullman, WA: Washington State University, Agricultural Experiment Station. 131 p.

The following references apply to Sections 332A and 332B:

U.S. Department of Interior, Fish and Wildlife Service, Sand Lake National Wildlife Refuge. [n.d.] Checklist of birds of Sand Lake National Wildlife Refuge. Columbia, SD: U.S. Department of Interior, Fish and Wildlife Service, Sand Lake National Wildlife Refuge. [Pages unknown].

U.S. Department of Interior, Fish and Wildlife Service, Lake Andes National Wildlife Refuge. 1983. Checklist of birds of Lake Andes National Wildlife Refuge. Lake Andes, SD: U.S. Department of Interior, Fish and Wildlife Service, Lake Andes National Wildlife Refuge. [Pages unknown].

The following references apply to Sections M331A, and M331B:

Clark, T.W.; [and others whose names are unknown]. 1989. Rare, sensitive, and threatened species of the greater Yellowstone ecosystem. Helena, MT: Montana Natural Heritage Program. 152 p. In cooperation with: Northern Rockies Conservation Cooperative.

The following references apply to Sections M331A, M331B, M332A, M332B, M332C, M332D, M332E, M333A, M333B, M333C, and M333D:

- Butts, T.W. 1992. Lynx biology and management, a literature review and annotated bibliography. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region. 115 p.
- Butts, T.W. 1992. Wolverine biology and management, a literature review and annotated bibliography. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region. 106 p.

The following references apply to Sections M331A, M331B, M332A, M332B, M332C, M332D, M332E, and 342A:

- U.S. Department of Interior, National Park Service, Yellowstone National Park. 1976. Birds of Yellowstone National Park. Yellowstone National Park, WY: U.S. Department of Interior, National Park Service, Yellowstone National Park. [Pages unknown].

The following references apply to Sections M331A, M331B and 342A:

- Young, Jack F.; Singleton, Paul C. 1977. Wyoming general soil map. [Place of publication unknown]: University of Wyoming, Agriculture Experiment Station. 40 p.

The following references apply to Sections M331D, M331E, and M331J:

- General soils map and landform provinces of Idaho [Soil and landform]. 1984. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service. 1: 1,000,000; [Projection unknown].
- Holdorf, H.; Donahue, J. 1990. Landforms for soil surveys in the northern Rockies. Miscellaneous Publication 51. Missoula, MT: University of Montana, Montana Forest and Conservation Experiment Station, School of Forestry. 26 p.
- Hydrologic atlas of Utah [Hydrology]. 1968. Logan, UT: Utah State University. [Scale not stated]; [Projection unknown].
- Johnson, K.J. 1989. Rangeland resources of Utah. Logan, UT: Utah State University, Cooperative Extension Service. 103 p.
- Oosting, H.J. 1956. The study of plant communities. San Francisco: W.H. Freeman and Co. 440 p.

The following references apply to Sections M331D, M331E, M331J, 341A, 341B, 341C, 341E, 341F, and 341G:

- U.S. Department of Agriculture, Soil Conservation Service. 1988. Soil survey of Carbon Area, Utah. [Place of publication unknown]: U.S. Department of Agriculture, Soil Conservation Service. [Pages unknown].

- U.S. Department of Agriculture, Forest Service, Ashley National Forest. [n.d.] Soil survey of the south unit Duchesne Ranger District, Ashley National Forest. Vernal, UT: U.S. Department of Agriculture, Forest Service, Ashley National Forest. [Pages unknown]. On file at U.S. Department of Agriculture, Forest Service, Ashley National Forest, 355 North Vernal Avenue, Vernal, UT 84078.

The following reference applies to Sections M331D, M331E, M331J, 341A, 341B, 341C, 341E, 341F, 341G, M341A, M341B, M341C, 342B, 342C, 342D, and 342E:

- Stokes, W.L. 1986. Geology of Utah. Occasional Paper 6. [Place of publication unknown]: University of Utah, Utah Museum of Natural History; Department of Natural Resources, Utah Geological and Mineral Survey. 280 p.

The following references apply to Sections M331D, M331E, M331J, 342B, 342C, 342D, and 342E:

- Potential natural vegetation map of Idaho [Vegetation]. 1986. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service. 1: 1,000,000; [Projection unknown].
- Ross, S.H.; Savage, C.N. 1967. Idaho earth science, geology, fossils, climate, water, and soils. [Place of publication unknown]: Idaho Bureau of Mines and Geology. 271 p.
- Shrader, J.A. 1977. Wyoming rangeland resources. [Publication identification number unknown]. Laramie, WY: University of Wyoming, Agricultural Experiment Station. 87 p.

The following references apply to Sections M332A, M332B, M332C, M332D and M332E:

- Roberts, H.B. 1992. Birds of east central Idaho. Boise, ID: Northwest Printing. 119 p.
- Subsection map of central Montana [Physiography]. 1981. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region. [Scale unknown]; [Projection unknown].

The following references apply to Sections M332A, M332B, M332C, M332D, M332E, M333B, M333C and M333D:

- Reichel, J.D.; Beckstrom, S.G. 1993. Northern bog lemming survey. Helena, MT: Montana Natural Heritage Program. Report to U.S. Department of Agriculture, Forest Service, Kootenai National Forest. 44 p.
- Subsection map of western Montana [Physiography]. 1976. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region. [Scale unknown]; [Projection unknown].

The following references apply to Section M332G:

Carlson, G. 1974. Soil resource inventory, Malheur National Forest. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 177 p.

Ehmer, L. 1978. Soil resource inventory, Umatilla National Forest. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. [Pages unknown].

Johnson, C.G. and R.R. Clausnitzer. 1992. Plant associations of the Blue and Ochoco Mountains. Report R6-ERW-TP-036-92. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 164 p.

Thomas, Jack Ward, tech. ed. 1979. Wildlife habitats in managed forests: the Blue Mountains of Oregon and Washington. Agric. Handb. 553. Washington, DC: U.S. Department of Agriculture. 512 p. In cooperation with: The Wildlife Management Institute; U.S. Department of Interior, Bureau of Land Management.

The following references apply to Sections M332G, 342H, and 342I:

Hopkins, W.E.; Kovalchik, B.L. 1983. Plant associations of the Crooked River National Grassland. Report R6-Ecol-133-1983. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 98 p.

Paulson, D.J. 1977. Ochoco National Forest soil resource inventory. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 289 p.

The following references apply to Section M333A:

Donaldson, N.C.; DeFrancesco, J.T.; Barron, D.W. 1982. Soil survey of Stevens County, Washington. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service. In cooperation with: U.S. Department of Agriculture, Forest Service; U.S. Department of Interior, Bureau of Indian Affairs; Washington State Department of Natural Resources; Washington State University, Agricultural Research Center. 459 p.

Donaldson, N.C.; DeFrancesco, J.T.; Haagen, M.E. [and others]. 1992. Soil survey of Pend Oreille County area, Washington. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service. In cooperation with: U.S. Department of Agriculture, Forest Service; Washington Department of Natural Resources; Washington State University, Agricultural Research Center. 427 p.

Williams, C.K.; Lillybridge, T.R.; Smith, B.G. 1990. Forested plant associations of the Colville National Forest. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 132 p.

The following reference applies to Sections M333A, M333B, and M333D:

Daubenmire, R.; Daubenmire, J. 1968. Forest vegetation of eastern Washington and northern Idaho. Technical Bulletin 60. Pullman, WA: Washington State University, Agricultural Experiment Station. 104 p.

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Appendix B

Approximate areas and proportionate extent of subregions at the Province and Section level in the United States (Area is given in square miles rounded to nearest 100, and percentage to nearest tenth.)

Province	Section	Area <i>mi</i> ²	Extent in Province	Extent in U.S.
			%	%
124	124A-Coastal Plain	19,100		0.5
125		46,900		1.3
	125A-Kotzebue Sound Lowlands	12,100	25.8	0.3
	125B-Yukon-Kuskokwim Delta	34,800	74.2	1.0
126	126A-Bristol Bay Lowlands	23,600		0.7
M121		101,600		2.8
	M121A-Foothills	47,200	46.5	1.3
	M121B-Mountains	54,400	53.5	1.5
M125	M125A-Seward Mountains	20,600		0.6
M126	M126A-Ahklun Mountains	16,700		0.5
M127		22,200		0.6
	M127A-Alaska Peninsula	14,600	65.7	0.4
	M127B-Aleutian Islands	4,500	20.3	0.1
	M127C-West Kodiak Island	3,100	14.0	0.1
131		56,100		1.6
	131A-Upper Kobuk Valley	16,900	30.1	0.5
	131B-Yukon-Kuskokwim Bottomlands	39,200	69.9	1.1
135		15,700		0.5
	135A-Cook Inlet Lowlands	9,600	61.1	0.3
	135B-Copper River Basin	6,100	38.9	0.2
139	139A-Upper Yukon Flats	13,000		0.4
M131		55,000		1.5
	M131A-Nulato Hills	19,600	35.6	0.5
	M131B-Kuskokwim Mountains	26,200	47.7	0.7
	M131C-Nushagak-Lime Hills	9,200	16.7	0.3
M135		61,000		1.7
	M135A-Alaska Mountains	48,100	78.9	1.3
	M135B-Wrangell Mountains	12,900	21.1	0.4
M139	M139A-Upper Yukon Highlands	68,400		1.9

Province	Section	Area mi ²	Extent in Province %	Extent in U.S. %
212		147,300		4.1
	212A-Aroostook Hills and Lowlands	3,800	2.6	0.1
	212B-Maine and New Brunswick Foothills and Eastern Lowlands	6,700	4.6	0.2
	212C-Fundy Coastal and Interior	2,400	1.6	0.1
	212D-Central Maine Coastal and Interior	4,600	3.1	0.1
	212E-St. Lawrence and Champlain Valley	4,600	3.1	0.1
	212F-Northern Glaciated Allegheny Plateau	21,300	14.5	0.6
	212G-Northern Unglaciated Allegheny Plateau	5,900	4.0	0.2
	212H-Northern Great Lakes	31,100	21.1	0.9
	212J-Southern Superior Uplands	30,300	20.6	0.8
	212K-Western Superior	8,200	5.6	0.2
	212L-Northern Superior Uplands	7,400	5.0	0.2
	212M-Northern Minnesota and Ontario	9,200	6.2	0.3
	212N-Northern Minnesota Draft and Lake Plains	11,800	8.0	0.3
M212		43,600		1.2
	M212A-White Mountains	17,600	40.4	0.4
	M212B-New England Piedmont	6,100	14.0	0.2
	M212C-Green, Taconic, Berkshire Mountains	7,100	16.3	0.2
	M212D-Adirondack Highlands	10,300	23.6	0.3
	M212E-Catskill Mountains	2,500	5.7	0.1
221		104,500		2.9
	221A-Lower New England	19,500	18.7	0.5
	221B-Hudson Valley	5,800	5.5	0.1
	221C-Upper Atlantic Coastal Plain	5,300	5.1	0.1
	221D-Northern Appalachian Piedmont	8,000	7.7	0.2
	221E-Southern Unglaciated Allegheny Plateau	31,500	30.1	0.9
	221F-Western Glaciated Allegheny Plateau	11,800	11.3	0.3
	221H-Northern Cumberland Plateau	13,800	13.2	0.4
	221I-Southern Cumberland Mountains	3,800	3.6	0.1
	221J-Central Ridge and Valley	5,000	4.8	0.1
222		270,000		7.5
	222A-Ozark Highlands	45,800	17.0	1.3
	222C-Upper Gulf Coastal Plain	10,600	3.9	0.3
	222D-Interior Low Plateau, Shawnee Hills	14,100	5.2	0.4
	222E-Interior Low Plateau, Highland Rim	29,400	10.9	0.8
	222F-Interior Low Plateau, Bluegrass	15,500	5.7	0.4
	222G-Central Till Plains, Oak-Hickory	16,000	5.9	0.4
	222H-Central Till Plains, Beech-Maple	27,100	10.0	0.8
	222I-Erie and Ontario Lake Plain	18,800	7.0	0.5
	222J-South Central Great Lakes	25,300	9.4	0.7
	222K-Southwestern Great Lakes Morainal	18,000	6.7	0.5
	222L-North-Central U.S. Driftless and Escarpment	16,600	6.1	0.5
	222M-Minnesota and Northeastern Iowa Morainal	29,400	10.9	0.8
	222N-Lake Agassiz, Aspen Parklands	3,400	1.3	0.1

Province	Section	Area mi ²	Extent in Province %	Extent in U.S. %
M221		68,100		1.9
	M221A-Northern Ridge and Valley	32,100	47.1	0.9
	M221B-Allegheny Mountains	9,500	14.0	0.3
	M221C-Northern Cumberland Mountains	5,500	8.1	0.1
	M221D-Blue Ridge Mountains	21,000	30.8	0.6
M222	M222A-Boston Mountains	6,400		0.2
231		193,000		5.4
	231A-Southern Appalachian Piedmont	73,200	37.9	2.0
	231B-Coastal Plains, Middle	56,900	29.5	1.5
	231C-Southern Cumberland Plateau	8,700	4.5	0.2
	231D-Southern Ridge and Valley	6,700	3.5	0.2
	231E-Mid Coastal Plains, Western	37,700	19.5	1.0
	231F-Eastern Gulf Prairies and Marshes	2,200	1.2	0.1
	231G-Arkansas Valley	7,600	3.9	0.2
232		173,800		4.8
	232A-Middle Atlantic Coastal Plain	17,800	10.2	0.5
	232B-Coastal Plains and Flatwoods, Lower	86,800	50.0	2.4
	232C-Atlantic Coastal Flatlands	23,300	13.4	0.6
	232D-Florida Coastal Lowlands (Western)	12,900	7.4	0.4
	232E-Louisiana Coast Prairies and Marshes	13,700	7.9	0.4
	232F-Coastal Plains and Flatwoods, Western Gulf	13,000	7.5	0.3
	232G-Florida Coastal Lowlands (Eastern)	6,300	3.6	0.2
234	234A-Mississippi Alluvial Basin	44,300		1.2
M231	M231A-Ouachita Mountains	8,800		0.2
242	242A-Willamette Valley and Puget Trough	14,900		0.4
M242		53,400		1.5
	M242A-Oregon and Washington Coast Ranges	15,700	29.4	0.5
	M242B-Western Cascades	15,400	28.8	0.4
	M242C-Eastern Cascades	22,300	41.8	0.6
M244		40,000		1.1
	M244A-Chugach-St. Elias Mountains	27,000	67.5	0.7
	M244B-Lynn Canal	5,900	14.7	0.2
	M244C-Boundary Range	7,100	17.8	0.2
M245		23,900		0.7
	M245A-Northern Gulf	7,400	30.9	0.2
	M245B-Northern Alexander Archipelago	5,800	24.3	0.2
	M245C-Southern Alexander Archipelago	10,700	44.8	0.3

Province	Section	Area <i>mi</i> ²	Extent in Province %	Extent in U.S. %
251		218,200		6.1
	251A-Red River Valley	18,300	8.4	0.5
	251B-North-Central Glaciated Plains	51,400	23.6	1.4
	251C-Central Dissected Till Plains	67,900	31.1	1.9
	251D-Central Till Plains	36,100	16.5	1.0
	251E-Osage Plains	18,100	8.3	0.5
	251F-Flint Hills	17,000	7.8	0.5
	251G-Central Loess Plains	9,400	4.3	0.3
255		80,100		2.2
	255A-Cross Timbers and Prairie	35,900	44.8	1.0
	255B-Blackland Prairies	13,200	16.5	0.4
	255C-Oak Woods and Prairies	21,900	27.3	0.6
	255D-Central Gulf Prairies and Marshes	9,100	11.4	0.2
261		10,300		0.3
	261A-Central California Coast	5,500	53.4	0.2
	261B-Southern California Coast	4,800	46.6	0.1
262	262A-Great Valley	19,200		0.5
263	263A-Northern California Coast	4,600		0.1
M261		68,300		1.9
	M261A-Klamath Mountains	16,100	23.6	0.4
	M261B-Northern California Coast Ranges	6,300	9.2	0.2
	M261C-Northern California Interior Coast Ranges	2,700	4.0	0.1
	M261D-Southern Cascades	6,300	9.2	0.2
	M261E-Sierra Nevada	18,200	26.6	0.5
	M261F-Sierra Nevada Foothills	8,900	13.0	0.2
	M261G-Modoc Plateau	9,800	14.4	0.3
M262		24,900		0.7
	M262A-Central California Coast Ranges	12,400	49.8	0.3
	M262B-Southern California Mountains and Valleys	12 500	50.2	0.4
311	311A-Redbed Plains	17,600		0.5
313		75,300		2.1
	313A-Grand Canyon	22,900	30.4	0.6
	313B-Navajo Canyonlands	21,900	29.1	0.6
	313C-Tonto Transition	17,400	23.1	0.5
	313D-Painted Desert	9,600	12.8	0.3
	313E-Central Rio Grande Intermontane	3,500	4.6	0.1

Province	Section	Area <i>mi</i> ²	Extent in Province %	Extent in U.S. %
315		160,900		4.5
	315A-Pecos Valley	19,400	12.0	0.5
	315B-Texas High Plains	48,400	30.1	1.4
	315C-Rolling Plains	38,800	24.1	1.1
	315D-Edwards Plateau	21,900	13.6	0.6
	315E-Rio Grande Plain	29,700	18.5	0.8
	315F-Southern Gulf Prairies and Marshes	2,700	1.7	0.1
M313		50,200		1.4
	M313A-White Mountain-San Francisco Peaks-Mogollon Rim	35,100	69.9	1.0
	M313B-Sacramento-Manzano Mountain	15,100	30.1	0.4
321		85,200		2.4
	321A-Basin and Range	72,900	85.6	2.0
	321B-Stockton Plateau	12,300	14.4	0.4
322		87,700		2.4
	322A-Mojave Desert	44,200	50.4	1.2
	322B-Sonoran Desert	38,700	44.1	1.1
	322C-Colorado Desert	4,800	5.5	0.1
331		290,700		8.1
	331A-Palouse Prairie	6,600	2.3	0.2
	331B-Southern High Plains	17,000	5.8	0.5
	331C-Central High Tablelands	25,700	8.8	0.7
	331D-Northwestern Glaciated Plains	40,700	14.0	1.1
	331E-Northern Glaciated Plains	26,900	9.3	0.7
	331F-Northwestern Great Plains	76,100	26.2	2.1
	331G-Powder River Basin	45,000	15.5	1.3
	331H-Central High Plains	23,300	8.0	0.6
	331I-Arkansas Tablelands	23,400	8.0	0.7
	331J-Northern Rio Grande Basin	6,000	2.1	0.2
332		134,000		3.7
	332A-Northeastern Glaciated Plains	27,900	20.8	0.8
	332B-Western Glaciated Plains	11,600	8.6	0.3
	332C-Nebraska Sand Hills	18,700	14.0	0.5
	332D-North-Central Great Plains	16,700	12.5	0.5
	332E-South-Central Great Plains	59,100	44.1	1.6
M331		102,300		2.8
	M331A-Yellowstone Highlands	13,400	13.1	0.4
	M331B-Bighorn Mountains	5,200	5.1	0.1
	M331D-Overthrust Mountains	17,900	17.5	0.5
	M331E-Uinta Mountains	7,400	7.2	0.2
	M331F-Southern Parks and Rocky Mountain Ranges	7,400	7.2	0.2
	M331G-South-Central Highlands	17,900	17.5	0.5
	M331H-North-Central Highlands and Rocky Mountain	12,100	11.8	0.3
	M331I-Northern Parks and Ranges	18,000	17.6	0.5
	M331J-Wind River Mountain	3,000	3.0	0.1

Province	Section	Area mi ²	Extent in Province %	Extent in U.S. %
M332		81,800		2.3
	M332A-Idaho Batholith	16,800	20.5	0.5
	M332B-Bitterroot Valley	7,500	9.2	0.2
	M332C-Rocky Mountain Front	2,700	3.3	0.1
	M332D-Belt Mountains	12,200	14.9	0.3
	M332E-Beaverhead Mountains	19,600	24.0	0.5
	M332F-Challis Volcanics	5,600	6.8	0.2
	M332G-Blue Mountains	17,400	21.3	0.5
M333		38,100		1.1
	M333A-Okanogan Highlands	13,000	34.1	0.4
	M333B-Flathead Valley	8,200	21.5	0.2
	M333C-Northern Rockies	4,100	10.8	0.1
	M333D-Bitterroot Mountains	12,800	33.6	0.4
M334	M334A-Black Hills	3,700		0.1
341		107,100		3.0
	341A-Bonneville Basin	25,600	23.9	0.7
	341B-Northern Canyon Lands	15,200	14.2	0.4
	341C-Uinta Basin	3,500	3.3	0.1
	341D-Mono	10,000	9.3	0.3
	341E-Lahontan Basin	25,500	23.8	0.7
	341F-Southeastern Great Basin	14,600	13.6	0.4
	341G-Northeastern Great Basin	12,700	11.9	0.4
342		159,100		4.4
	342A-Bighorn Basin	7,600	4.8	0.2
	342B-Northwestern Basin and Range	44,500	28.0	1.2
	342C-Owyhee Uplands	28,700	18.0	0.8
	342D-Snake River Basalts	10,300	6.5	0.3
	342E-Bear Lake	3,100	1.9	0.1
	342F-Central Basin and Hills	15,700	9.9	0.4
	342G-Green River Basin	19,600	12.3	0.6
	342H-High Lava Plains	8,200	5.1	0.2
	342I-Columbia Basin	21,400	13.5	0.6
M341		43,600		1.2
	M341A-Central Great Basin Mountains	24,400	56.0	0.7
	M341B-Tavaputs Plateau	7,000	16.0	0.2
	M341C-Utah High Plateaus and Mountains	12,200	28.0	0.3
411	411A-Everglades	7,800		0.2
M411	M411A-Dry-Humid Mountains	3,700		0.1
M423	M423A-Hawaiian Islands	6,500		0.2
TOTAL		3,592,800		

Appendix C

Glossary of selected terms

Included are definitions of selected terms that may not be commonly known to the user of this document. This abbreviated glossary does not include the many, specialized terms used to describe taxa of geologic and soil classifications. Some of the more general geology and soil terms are defined in the glossary of the table that supplements the map of ecoregions and subregions of the U.S. For other definitions the user is directed to references such as Bates and Jackson (1980) for geologic terms and Soil Survey Staff (1992) for soil terminology.

ALLUVIUM—A general term for clay, silt, sand, gravel, or similar unconsolidated detrital material deposited during comparatively recent geologic time by a stream or other body of running water as a sorted or semisorted sediment in the bed of the stream. (Bates and Jackson 1980.)

CIRQUE—A deep steep-walled half-bowl-like recess or hollow situated high on the side of a mountain and commonly at the head of a glacial valley, and produced by the erosive activity of a mountain glacier. (Bates and Jackson 1980.)

COLD-DECIDUOUS BROADLEAF—Woody angiosperms with wide, flat leaves (e.g., paper birch) that are shed by plants during the dormant season (that portion of the year when frosts occur).

COLLUVIUM—A general term applied to any loose, heterogeneous, and incoherent mass of soil material and/or rock fragments deposited by rainwash, sheetwash, or slow continuous downslope creep, usually collecting at the base of gentle slopes or hillsides. (Bates and Jackson 1980.)

CUESTA—A hill or ridge with a gentle slope on one side and a steep slope on the other; formed by uplifted rock outcrop consisting of strata having different resistances to erosion. (Bates and Jackson 1980.)

DIVISION—An ecological unit in the ecoregion planning and analysis scale of the National Hierarchical Framework corresponding to subdivisions of a Domain that have the same regional climate. (ECOMAP 1993.)

DOMAIN—An ecological unit in the ecoregion planning and analysis scale of the National Hierarchical Framework corresponding to subcontinental divisions of broad climatic similarity that are affected by latitude and global atmospheric conditions. (ECOMAP 1993.)

DRUMLIN—An elongated hill or ridge of glacial drift.

DRY—A classification of climate based on the Köppen System for regions where evaporation exceeds precipitation. (Bailey 1980.)

ECOREGION—A scale of planning and analysis in the National Hierarchical Framework that has broad applicability for modeling and sampling, strategic planning and assessment, and international planning. Ecoregions include Domain, Division, and Province ecological units.

ECOSYSTEM—A complete interacting system of organisms and their environment. (FSM 2060.)

FLOODPLAIN—The surface or strip of relatively smooth land adjacent to a river channel, constructed by the present river in its existing regimen and covered with water when the river overflows its banks. (Bates and Jackson 1980.)

LIFE ZONES—A classification of macroclimatic conditions based on temperature and precipitation that has been widely applied in tropical environments to delineate zones dominated by vegetative communities of characteristic physiognomy and composition. (Holdridge 1967.)

MARINE AND ESTUARINE PROVINCE—Regionalizations at the System level of the wetland classification system developed by Cowardin and others (1979) consisting of the open ocean overlying the continental shelf and adjacent areas of coastlines that are influenced by tidal activity.

MORaine—A mound, ridge, or other distinct accumulation of unsorted, unstratified glacial drift, predominantly till, deposited chiefly by direct action of glacier ice, in a variety of topographic landforms that are independent of control by the surface on which the drift lies. (Bates and Jackson 1980.)

NEEDLE-LEAVED EVERGREEN—Woody gymnosperms with green, needle-shaped, or scale-like leaves (e.g., black spruce) that are retained by plants throughout the year. (Cowardin and others 1979.)

PLANT ASSOCIATION—A potential natural plant community of definite floristic composition and uniform appearance. (FSM 2060.)

PLANT COMMUNITY—A group of one or more populations of plants in a common spatial arrangement. (FSM 2060.)

PLAYA—A term used in the southwestern U.S. for a dry, vegetation-free, flat area at the lowest part of an undrained desert basin, underlain by stratified clay, silt, or sand, and commonly by soluble salts. (Bates and Jackson 1980.)

POLAR—A classification of climate based on the Köppen System for regions where the warmest month is colder than 50°F (10°C). (Bailey 1980.)

POTENTIAL NATURAL COMMUNITY—The biotic community that would be established if all successional sequences of its ecosystem were completed without additional human-caused disturbance under present environmental conditions. Grazing by native fauna, natural disturbances, such as drought, floods, fire, insects, and disease, are inherent in the development of potential natural communities which may include naturalized exotic species. (FSM 2060.)

POTENTIAL NATURAL VEGETATION—The vegetation that would exist today if man were removed from the scene and if the plant succession after his removal were telescoped into a single moment. The time compression eliminates the effects of future climatic fluctuations, while the effects of man's earlier activities are permitted to stand. The maps and descriptions of potential natural vegetation developed by Küchler (1964) for the 48 conterminous States are among the most widely used.

POTHOLE—A shallow depression, generally less than 10 acres in area, occurring between dunes on a prairie, often containing an intermittent pond or marsh and serving as a nesting place for waterfowl. (Bates and Jackson 1980.)

PROVINCE—An ecological unit in the ecoregion planning and analysis scale of the National Hierarchical Framework corresponding to subdivisions of a Division that conform to climatic subzones controlled mainly by continental weather patterns. (ECOMAP 1993.)

REGIONALIZATION—A mapping procedure in which a set of criteria are used to subdivide the earth's surface into smaller, more homogeneous units that display spatial patterns related to ecosystem structure, composition, and function. (ECOMAP 1993.)

SCALE—The degree of resolution at which ecological processes, structures, and changes across space and time are observed and measured. (ECOMAP 1993.)

SECTION—An ecological unit in the subregion planning and analysis scale of the National Hierarchical Framework corresponding to subdivisions of a Province having broad areas of similar geomorphic process, stratigraphy, geologic origin, drainage networks, topography, and regional climate. Such areas are often inferred by relating geologic maps to potential natural vegetation groupings as mapped by Küchler (1964). (ECOMAP 1993.)

SUBENVELOP—The general altitude of the drainage network that portrays differences in stream gradient from one geomorphic unit to another.

SUBREGION—A scale of planning and analysis in the National Hierarchical Framework that has applicability for strategic, multi-forest, statewide, and multi-agency analysis and assessment. Subregions include Section and Subsection ecological units.

SUBSECTION—An ecological unit in the subregion planning and analysis scale of the National Hierarchical Framework corresponding to subdivisions of a Section into areas with similar surficial geology, lithology, geomorphic process, soil groups, subregional climate, and potential natural communities. (ECOMAP 1993.)

SUBTROPICAL—A classification of climate based on the Köppen System for regions where there are eight months or more warmer than 50°F (10°C) and the coolest month is warmer than 32°F (0°C) but colder than 65°F (18°C). (Bailey 1980.)

TEMPERATE—A classification of climate based on the Köppen System for regions where there are four to eight months warmer than 50°F (10°C) and the coldest month is cooler than 32°F (0°C). (Bailey 1980.)

TROPICAL—A classification of climate based on the Köppen System for regions where the coolest month is warmer than 65°F (18°C) (Bailey 1980.)

TUNDRA—A classification of climate based on the Köppen System for regions where the warmest month is colder than 50°F (10°C) but warmer than 32°F (0°C). (Bailey 1980.)

Appendix D

Common and scientific names of selected flora and fauna

This list contains species for which compilers provided scientific names in the Section descriptions. Listed also are other species identified in potential natural vegetation and fauna elements that may be considered as generally characteristic of each Domain. Alternate common names are in parentheses. Species are grouped by flora or fauna within a Domain.

Domain 100

Flora

Birch, paper	<i>Betula papyrifera</i>
Poplar, balsam	<i>Populus balsamifera</i>
Spruce, black	<i>Picea mariana</i>
Spruce, white	<i>Picea glauca</i>
Tamarack (eastern larch)	<i>Larix laricina</i>
Willow, feltleaf	<i>Salix alaxensis</i>

Fauna

Auklet, whiskered	<i>Aethia pygmaea</i>
Bear, grizzly (brown)	<i>Ursus arctos</i>
Bear, polar	<i>Ursus maritimus</i>
Caribou	<i>Rangifer tarandus</i>
Curlew, bristle-thighed	<i>Numenius tahitiensis</i>
Char, Arctic	<i>Salvelinus alpinus</i>
Eider, spectacled	<i>Lampronetta fischeri</i>
Falcon, peregrine	<i>Falco peregrinus</i>
Fox, Arctic	<i>Alopex lagopus</i>
Grayling, Arctic	<i>Thymallus arcticus</i>
Grebe, horned	<i>Podiceps auritus</i>
Grebe, red-necked	<i>Podiceps grisegena</i>
Guillemot, black	<i>Cepphus grylle</i>
Gull, glaucous	<i>Larus hyperboreus</i>
Hare, Arctic (Alaskan)	<i>Lepus arcticus</i>
Jaeger, pomarine	<i>Stercorarius pomarinus</i>
Lark, horned	<i>Eremophila alpestris</i>
Lemming, northern bog	<i>Synaptomys borealis</i>
Longspur, Smith's	<i>Calcarius pictus</i>
Loon, Arctic	<i>Gavia arctica</i>
Lynx	<i>Felis lynx</i>
Moose	<i>Alces alces</i>
Myotis, little brown	<i>Myotis lucifugus</i>
Muskox	<i>Ovibos moschatus</i>
Otter, sea	<i>Enhydra lutris</i>
Owl, snowy	<i>Nyctea scandiaca</i>
Ptarmigan, willow	<i>Lagopus lagopus</i>
Salmon, chum	<i>Oncorhynchus keta</i>
Salmon, chinook (king)	<i>Oncorhynchus tshawytscha</i>
Salmon, pink	<i>Oncorhynchus gorbuscha</i>
Sandpiper, curlew	<i>Erolia ferruginea</i>
Seal, northern fur (Alaska fur)	<i>Callorhinus ursinus</i>
Seal, ribbon	<i>Phoca fasciata</i>
Sea lion, Steller (northern)	<i>Eumetopias jubatus</i>
Inconnu (Alaska Sheefish)	<i>Stenodus leucichthys</i>
Sheep, dall	<i>Ovis dalli</i>
Shrew, Arctic (saddle-backed)	<i>Sorex arcticus</i>

Swan, whistline (tundra)	<i>Olor columbianus</i>
Trout, rainbow	<i>Salmo gairdneri</i>
Turnstone, black	<i>Arenaria melanocephala</i>
Turnstone, ruddy	<i>Arenaria interpres</i>
Vole, insular	<i>Microtus abbreviatus</i>
Vole, tundra	<i>Microtus oeconomus</i>
Vole, yellow-cheeked	<i>Microtus xanthognathus</i>
Weasel, short-tailed (ermine)	<i>Mustela erminea</i>
Walrus	<i>Odobenus rosmarus</i>
Wolverine (skunk bear)	<i>Gulo gulo</i>

Domain 200

Flora

Fescue, green	<i>Festuca virida</i>
Fescue, Idaho	<i>Festuca idahoensis</i>
Fir, Douglas	<i>Pseudotsuga menziesii</i>
Fir, grand	<i>Abies grandis</i>
Fir, Pacific silver	<i>Abies amabilis</i>
Fir, subalpine	<i>Abies lasiocarpa</i>
Fir, white	<i>Abies concolor</i>
Hemlock, mountain	<i>Tsuga mertensiana</i>
Hemlock, western	<i>Tsuga heterophylla</i>
Junegrass, prairie	<i>Koeleria cristata</i>
Mahogany, mountain (curleaf)	<i>Cercocarpus ledifolius</i>
Maple, bigleaf	<i>Acer macrophyllum</i>
Oak, Oregon white	<i>Quercus garryana</i>
Pine, loblolly	<i>Pinus taeda</i>
Pine, lodgepole	<i>Pinus contorta</i>
Pine, longleaf	<i>Pinus palustris</i>
Pine, ponderosa	<i>Pinus ponderosa</i>
Pine, sand	<i>Pinus clausa</i>
Pine, shortleaf	<i>Pinus echinata</i>
Pine, slash	<i>Pinus elliotii</i>
Pine, white bark	<i>Pinus albicaulis</i>
Red cedar, western	<i>Thuja plicata</i>
Snowberry (mountain balm)	<i>Ceanothus velutinus</i>
Spruce, Engelman	<i>Picea engelmannii</i>
Spruce, Sitka (coast)	<i>Picea sitchensis</i>
Yew, Pacific	<i>Taxus brevifolia</i>

Fauna

Beaver, mountain (sewellel)	<i>Aplodontia rufa</i>
Beetle, American burying	<i>Nicrophorus americanus</i>
Butterfly, Karner blue	<i>Lycaeides melissa samuelis</i>
Butterfly, Mexican silverspot	<i>Dione moneta</i>
Dolly Varden (bull trout)	<i>Salvelinus malma</i>
Goat, mountain	<i>Oreamnos americanus</i>
Gopher, camas pocket	<i>Thomomys bulbivorus</i>
Grouse, blue	<i>Dendragapus obscurus</i>
Kinglet, golden-crowned	<i>Regulus satrapa</i>
Moth, gypsy	<i>Porthetria dispar</i>
Owl, northern spotted	<i>Strix occidentalis caurina</i>
Pigeon, band-tailed	<i>Columba fasciata</i>
Sapsucker (red-breasted race)	<i>Sphyrapicus varius</i>
Toad, boreal	<i>Bufo boreau boreau</i>

Trout, brook *Salvelinus fontinalis*
 Trout, cutthroat (Yellowstone) *Salmo clarki*
 Woodpecker, red-cockaded *Dendrocopos borealis*

Domain 300

Flora

Bluegrass, Sandbergs *Poa sandbergii*
 Cactus, saguaro *Cereus giganteus*
 Hairgrass, tufted *Deschampsia caespitosa*
 Juniper, western *Juniperus occidentalis*
 Needle-and-thread *Stipa comata*
 Sage, low *Artemisia aristida*
 Sagebrush, big *Artemisia tridentata*
 Sagebrush, black *Artemisia arbuscula*
 Snowberry, common *Symphoricarpos albus*
 Wheatgrass, bluebunch *Agropyron spicatum*

Fauna

Bison *Bison bison*
 Boa, rubber *Charina bottae*
 Deer, mule (black-tailed) *Odocoileus hemionus*
 Chipmunk, alpine *Eutamias alpinus*
 Chipmunk, California *Eutamias obscurus*
 Chipmunk, Sonoma *Eutamias sonomae*
 Cottontail, desert *Sylvilagus audubonii*
 Dove, Inca *Scardafella inca*
 Ferret, black-footed *Mustela nigripes*
 Fox, swift *Vulpes velox*
 Frog, Rio Grande leopard *Rana berlandieri*
 Goshawk, northern *Accipiter gentilis*
 Jackrabbit, black-tailed *Lepus californicus*
 Jackrabbit, white-tailed *Lepus townsendii*
 Jaguar *Felis onca*
 Lizard, leopard *Gambelia wislizenii*
 Myotis, California *Myotis californicus*
 Myotis, yuma *Myotis yumanensis*
 Oscelet *Felis pardalis*
 Owl, flammulated *Otus flammeolus*
 Prairie dog, black-tailed *Cynomys ludovicianus*
 Prairie dog, white-tailed *Cynomys leucurus*
 Pronghorn (American antelope) *Antilocapra americana*
 Pyrrhuloxia *Pyrrhuloxia sinuata*
 Quail, scaled *Callipepla squamata*
 Rat, Merriam's kangaroo *Dipodomys merriami*
 Ringtail *Bassariscus astutus*
 Salamander, Utah tiger *Ambystome tigrinum*
 Sheep, bighorn *Ovis canadensis*
 Shiner, Columbia redbelt *Richardsonius balteatus*
 Shrew, desert *Notiosorex crawfordi*
 Sparrow, sage *Amphispiza belli*
 Squirrel, Arizona gray *Sciurus arizonensis*
 Squirrel, Albert's *Sciurus aberti*
 Swallow, cave *Petrochelidon fulva*
 Toad, Great Basin spadefoot *Scaphiopus intermontanus*
 Toad, Great Plains *Bufo cognatus*
 Toad, western *Bufo boreas*
 Tortoise, desert *Gopherus agassizii*
 Turtle, Mexican mud *Kinosternon hirtipes*
 Vole, prairie *Microtus ochrogaster*

Vole, sagebrush *Lagurus curtatus*
 Wolf, gray (timber) *Canis lupus*

Domain 400

Flora

Almacigo (gumbo-limbo) *Bursera simaruba*
 Algarrobo *Hymenaea courbaril*
 Aroma *Acacia farnesiana*
 Ausubo *Manilkara bidentata*
 Bayahonda (mesquite) *Prosopis juliflora*
 Bucayo gigante *Erythrina poeppigiana*
 Caimitillo *Micropholis chrysophylloides*
 Caimitillo verde *Micropholis garciniaefolia*
 Cajuput *Melaleuca leucadendron*
 Cedro hembra *Cedrela odorata*
 Cephalocereus, Key West *Cephalocereus keyensis*
 Florida fishpoison-tree *Piscidia piscipula*
 Flamboyant (royal poinciana) *Delonix regia*
 Guama *Inga laurina*
 Guava *Psidium guayava*
 Guayacan *Guaiacum officinale*
 Guayacan blanco *Guaiacum sanctum*
 Helecho gigante *Cyathea arborea*
 Hyacinth, water *Eichhornia crassipes*
 Jaguey blanco (shortleaf fig) *Ficus laevigata*
 Koa *Acacia koa*
 Lysiloma, Bahama *Lysiloma bahamensis*
 Mangrove, black *Avicennia nitida*
 Mangrove, button *Conocarpus erectus*
 Mangrove, red *Rhizophora mangle*
 Mangrove, white *Laguncularia racemosa*
 Motillo *Sloanea berteriana*
 Nemoca *Ocotea spathulata*
 O'hia lehua *Metrosideros polymorpha*
 Palma de sierra *Prestoea montana*
 Palma de lluvia *Guassia attenuata*
 Palma real *Roystonea borinquena*
 Palo colorado (swamp cyrilla) *Cyrilla racemiflora*
 Palo de pollo *Pterocarpus officinalis*
 Pine, south Florida slash *Pinus elliottii*
 Quenepa *Melicoccus bifugatus*
 Roble blanco *Tabebuia heterophylla*
 Royalpalm, Florida *Roystonea elata*
 Sawgrass *Cladium jamaicensis*
 Sebecan *Cephalocereus royerii*
 Spiny tree-fern *Nephelea portoricensis*
 Tabonuco *Dacryodes excelsa*
 Tachuelo *Pictetia aculeata*
 Tamarindo (tamarind) *Tamarindus indica*
 Tamarindo silvestre *Acacia macracantha*
 Tulipan africano *Spathodea campanulata*
 Ucar (oxhorn bucida) *Bucida buceras*
 Zarcilla *Leucaena glauca*

Fauna

Bat, Hawaiian (red) (hoary) *Lasiurus spp.*
 Parrot, Puerto Rican *Amazona vittata vittata*
 Snail, Everglades tree *Liguus spp.*

Appendix E

Addresses of Principal Compilers

Comments, error corrections, reports of new knowledge, or other information pertaining to Section map unit descriptions should be addressed to the Principal Compiler at the Forest Service Region responsible for compilation:

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